

UNITED STATES OF AMERICA:  
WAR DEPARTMENT.

---

# MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

DECEMBER, 1885.

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PREPARED UNDER THE DIRECTION OF  
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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C. in time to be used in the preparation of the Weather Review for the month of December, 1885.

Name of vessel.	Observers.	Name of vessel.	Observers.	Name of vessel.	Observers.
<b>Alban Line.</b>		<b>Mediterranean &amp; New York Steamship Co.</b>		<b>Warren Line.</b>	
Br. s. s. Grecian	Capt. C. E. LeGallais.	Br. s. s. Ponca	Capt. William Bowen.	Br. s. s. Iowa	Capt. Samuel Walters.
Manitoba	R. Carruthers.	Miss. & Dominion S. S. Co.		Missouri	R. Poland.
Prussian	A. McDougall.	Br. s. s. Montreal	F. Bouchette.	Norseman	E. Maddox.
Sarmatian	Wm. Richardson.	Toronto	Jas. McAnley.	White Cross Line.	
Scandinavian	John Park.	Monarch Line.		Belg. s. s. De Ruyter	J. J. Brarons.
Siberian	R. P. Moore.	Br. s. s. Assyrian Monarch	John Harrison.	Jan Breydel	H. Meyer.
<b>American Line.</b>		Egyptian Monarch	W. S. Morgan.	Pieter de Coninck	E. Smit.
Br. s. s. British King	John King.	Grecian Monarch	B. J. W. Bristow.	White Star Line.	
British Prince	Samuel Nowell.	Lydian Monarch	Thos. C. Huggett.	Br. s. s. Adriatic	H. Parsell.
British Princess	E. H. Froeth.	Persian Monarch	J. Watson.	Baltic	Geo. Burton.
Am. Indiana	H. W. Sargent.	Morgan's La. & Texas E. N. & S. S. Co.		Celtic	Benj. Glendell.
Br. Lord Clive	P. Urquhart.	Am. s. s. Chalmette	Robt. B. Quick.	Germanic	C. W. Kennedy.
Lord Gough	E. M. Hughes.	El Dorado	J. W. Hawthorne.	Republic	P. J. Irving.
<b>Anchor Line.</b>		Lone Star	Geo. W. Mason.	Wilson Line.	
Br. s. s. Australia	Alex. McRitchie.	National Line.		Br. s. s. Bravo	Charles Smith.
Circassia	A. Campbell.	Br. s. s. Canada	Wm. Pearce.	Bassano	T. J. Moore.
Columbia	H. Th. Garvie.	Denmark	Geo. Cochran.	Chicago	J. W. Jones.
Devonia	Hugh Young.	England	T. P. Healey.	Gallio	Richard Potter.
Ethiopia	John Wilson.	Erin	John Robinson.	Lepanto	Wm. Abbott.
Olympia	James Brown.	France	A. D. Hadley.	Otranto	F. Kerr.
Trinacria	Geo. Mitchell.	Helvetia	John Milligan.	Salerno	Wm. Abbott.
<b>Anglo-Australian Steamship Company.</b>		Holland	Wm. Tyson.	<b>Miscellaneous.</b>	
Br. s. s. Port Phillip	Geo. Dulling.	It. s. s. Archimede	Domenico Viola.	Br. s. s. Aboraca	Robt. Temple.
<b>Atlantic Transportation Company.</b>		Independente	P. Pirandello.	Ger. Brutus	J. A. Voegel.
Br. s. s. Surrey	H. Murrell.	Gottardo	G. Diliberto.	Bedford	Thos. Aitkenhead.
<b>Atlas Line.</b>		<b>New York and Cuba Mail S. S. Co.</b>		Camden	S. B. Chandler.
Br. s. s. Alisa	J. W. Sansom.	Am. s. s. Cienfuegos	C. M. Faircloth.	Cranbrook	John W. Harvey.
Albano	H. R. Hughes.	N. Y. Havana & Mexican Mail S. S. Co.		Coventry	W. C. Bacon.
Alvo	David Williams.	Am. s. s. City of Alexandria	J. W. Reynolds.	Edith Golden	John H. Bennett.
Span. Andes	D. de Amésaga.	City of Washington	W. M. Rettig.	El Callao	Jos. Scholtz.
Antillas	H. Moran.	<b>North German Lloyd Steamship Co.</b>		Elstow	Thos. Robertson.
Br. Charibel	T. M. McKnight.	Ger. s. s. America	G. Meyer.	Br. Joseph Fereis	A. de Mugica.
<b>Booth's S. S. Co. (limited).</b>		Donau	C. Poble.	Am. Lorenzo D. Baker	John J. Mehegan.
Br. s. s. Clement	Thomas Burley.	Elder	H. Helmers.	Br. Matthew Bedlington	Warren F. Wiley.
Cyril	J. H. Johnson.	Elbe	F. Hamelmann.	Maedonits	Thos. Kirby.
<b>Bristol-City Line.</b>		Ems	W. Willigerod.	Menzech	J. B. McKie.
Br. s. s. Brooklyn City	W. Fitt.	Fulda	A. Meier.	Neustria	P. Verriers.
Liverpool City	T. H. Gore.	Hohenollern	H. Ringk.	Netley Abbey	H. N. Vyvyan.
Wells City	T. L. Weiss.	Main	A. Christoffers.	Oxfordshire	C. P. Jones.
<b>California and Mexican Steamship Co.</b>		Neckar	P. Pfeifer.	Pomona	C. E. Cook.
Am. s. s. Newbern	E. Middlestadt.	Nürnberg	A. Jaeger.	Pradain	Moore Parry.
<b>Canada Shipping Co.</b>		Rhein	Th. Jungst.	Ger. Ralates	J. Viereck.
Br. s. s. Lake Nepigon	M. L. Tranmar.	Werra	H. Bussius.	Br. Roman	David Williams.
<b>Cromwell Line.</b>		Weser	H. Bruns.	Rydal Water	H. J. Jones.
Am. s. s. Louisiana	E. N. Gager.	<b>Occidental and Oriental Steamship Co.</b>		St. Bonans	Henry Campbell.
Hudson	H. R. Freeman.	Br. s. s. Oceano	John Metcalfe.	Valencia	Ch. Off. J. A. Estopiñá.
<b>Choward Line.</b>		<b>Ocean Steamship Company.</b>		Br. Vertumnus	Capt. John Legoe.
Br. s. s. Aurania	W. H. P. Hains.	Am. s. s. City of Augusta	K. S. Nickerson.	Viola	L. Murray.
Catalonia	Alex. McKay.	Junata	S. L. Askins.	<b>Sailing vessels.</b>	
Cephalonia	Henry Walker.	Chattahoochee	J. W. Catharine.	Am. bg. Abbie Clifford	D. W. Stores.
Etruria	T. Cook.	Nacoochee	Ch. Off. C. G. S. Burg.	Am. sc. Abbie H. Gheen	W. W. Gheen.
Gallia	M. Murphy.	<b>Oceanic Steamship Company.</b>		Br. bg. Achmah	Alfred M. Shaw.
Oregon	P. Cottler.	Am. s. s. Mariposa	Capt. H. M. Hayward.	Am. sc. Annie R. Lewis	L. L. Lewis.
Pavonia	D. Woolfenden.	Old Dominion Steamship Company.		bkt. Antonio Sala	F. H. Mitchell.
Servia	W. McMickan.	Am. s. s. Manhattan	Frank Stevens.	Am. sc. Anna T. Eberner	Wm. W. Cherry.
<b>Edward Carr's S. S. Line.</b>		<b>Oregon Railway and Navigation Co.</b>		Br. sp. Charles S. Whitney	Geo. D. Spicer.
Ger. s. s. Australia	G. Franck.	Am. s. s. City of Chester	Thomas Wallace.	Ger. sp. Derby	B. Fortmann.
California	O. Winkler.	Columbia	Fred Bolles.	Ger. bk. Diamant	H. Haesloep.
Europa	L. A. Kessal.	Oregon	E. Polemann.	Am. bk. Don Junte	Jerome P. Jones.
Polynesia	A. Kuhn.	<b>Pacific Coast Steamship Company.</b>		Br. sp. E. J. Spicer	Dewie Spicer.
<b>Furues Line.</b>		Am. s. s. Orizaba	John N. Ingalls.	Am. sc. Ettie H. Lister	Smith D. Mason.
Br. s. s. Albania	W. Malloney.	State of California	G. Debey.	Br. bk. Exile	Geo. J. Pearce.
Durham City	M. P. Lund.	Santa Rosa	C. B. Johnson.	Dan. bk. Galeon	H. H. Kalsboll.
Stockholm City	K. Doyle.	<b>Pacific Mail Steamship Company.</b>		bk. Gamaliel	C. S. Powell.
<b>General Trans-Atlantic Steamship Co.</b>		Am. s. s. Acapulco	W. G. Shackford.	Ger. bk. George Washington	J. Probet.
Fr. s. s. Amélie	E. Santelli.	Australia	G. S. Brough.	Am. sc. Governor Hall	John Cain, Jr.
Canada	G. de Kersabiec.	City of New York	Robt. R. Searle.	Am. bkt. Harriet S. Jackson	W. F. Bacon.
St. Germain	E. Traub.	City of Paris	L. Dexter.	Ger. bk. Heinrich & Tonio	L. Meyer.
Labrador	P. d'Hauterive.	City of Peking	G. G. Berry.	Am. sc. Henry Waddington	W. H. Magee.
Normandie	E. Frangini.	City of Rio Janeiro	Wm. R. Cobb.	Br. sp. Hermon	F. N. Marvin.
St. Laurent	M. de Jouselin.	City of Sydney	J. M. Caverly.	Am. bk. Idaho	W. S. Richardson.
<b>Great Western S. S. Line.</b>		Colima	W. R. Seabury.	Br. bg. Lillian	H. F. Schive.
Br. s. s. Dorset	Ch. Off. Wm. H. Bates.	Granada	Thos. Chapman.	Am. bg. L. & W. Armstrong	A. Alexander.
Warwick	Capt. P. F. Lobbett.	San Blas	A. D. Austin.	bg. Mary Fluk	Daniel B. Darrah.
<b>Gruin Line.</b>		San José		Am. sc. Nelson Bartlett	Samuel Watts.
Br. s. s. Abyssinia	J. Price, B. N. B.	<b>Quebec Steamship Company.</b>		Nor. bk. Nordcap	E. Salvesen.
Alaska	Geo. S. Murray.	Br. s. s. Bermuda	R. Fraser.	Am. s. s. Acapulco	W. G. Shackford.
Arizona	J. Price, B. N. B.	Muriel	G. S. Locke.	Br. Adriatic	H. Parsell.
Nevada	John Douglas.	Orinoco	Jas. S. Garvin.	Am. Advance	J. R. Beers.
Wisconsin	Edward Bentley.	<b>Red "D" Line.</b>		Br. Ailen	J. W. Sansom.
Wyoming	C. L. Rigby.	Am. s. s. Caracae	W. M. Hopkins.	Albano	H. B. Hughes.
<b>Hamburg-American Line.</b>		Philadelphia	Sam. Hess.	Alene	E. J. Seiders.
Ger. s. s. Bohemia	B. Karlowa.	Valencia	Wm. Woodrick.	Algiers	J. B. Percy.
Gellert	W. Kuhlwein.	<b>Red Star Line.</b>		Br. Alvo	D. Williams.
Lessing	B. Voss.	Belg. s. s. Belgenland	W. A. Beynon.	Arizona	Sam. Brooks.
Moravia	O. Vogelstang.	Nederland	Allen J. Griffin.	Baltic	G. Burton.
Rhaetia	H. Vogelstang.	Noordland	H. E. Nickels.	Belgenland	W. A. Beynon.
Rugia	A. Albers.	Pennland	Rud. Weyer.	Britannic	H. Perry.
Suevia	C. Ludwig.	Rhynland	J. C. Jamison.	City of Alexandria	J. W. Reynolds.
Wieland	C. Heibich.	Switzerland	H. Buschmann.	City of Chicago	Fred Watkins.
<b>Imman Line.</b>		Waeland	J. Ueberweg.	Celtic	Benj. Glendell.
Br. s. s. City of Berlin	Francis S. Land.	Westernland	Com. W. G. Handie.	City of Puebla	John Deaken.
City of Chicago	Fred Watkins.	Zeeland	Capt. L. De Smet.	Claribel	T. M. McKnight.
City of Richmond	A. W. Lewis.	<b>Rotterdam Line.</b>		Am. Colon	Arthur Lewis.
<b>Johnson Line.</b>		Ditch. s. s. Edam	J. H. Taat.	Chalmette	Chas. Lima.
Br. s. s. Neesmore	John Inch.	Leerdam	P. Slierendregt.	Ems	Robt. R. Quick.
<b>Lamport &amp; Holt's Steamship Company.</b>		P. Caland	T. H. Boujer.	Gallia	W. Willigerod.
Br. s. s. Beesol	Chas. J. Watson.	Schiedam	G. Bakker.	Geiser	M. Murphy.
Biela	Fred Graham.	W. A. Scholten	G. J. Vis.	Lessing	F. V. Schierbeck.
Dalton	J. Russell.	<b>State Line.</b>		Belg. Nederland	B. Voss.
Euclid	Alex. W. Pym.	Br. s. s. State of Georgia	G. Moodie.	Olympia	A. J. Griffin.
Halley	W. P. Ballentine.	State of Indiana	A. Bitchie.	Oregon	James Brown.
Hevelius	John Carroll.	State of Nebraska	A. G. Braes.	Orinoco	P. Cottler.
Br. s. s. Hipparchus	Wm. Kelly.	State of Nevada	John A. Stewart.	Br. s. s. Paland	S. Garvin.
Laurel	Robt. Graham.	State of Pennsylvania	Alfred Mann.	Persian Monarch	F. H. Bonjer.
Moxart	Wm. Spratt.	<b>Thingalla Line.</b>		Pennland	Jas. Watson.
Obere	James Clarke.	Dan. s. s. Geiser	F. V. Schierbeck.	Republic	P. J. Irving.
Plato	John P. Bevis.	Hekla	A. G. Thomsen.	Rhynland	J. C. Jamison.
Belg. s. s. Rous	James Dixon.	Island	W. Skjott.	San Marcos	Ch. Off. A. B. Connor.
<b>Legland Line.</b>		Thingalla	S. T. H. Laub.	Schiedam	Capt. G. Bakker.
Br. s. s. Venetian	W. H. Trant.	<b>U. S. and Brazil Mail S. S. Co.</b>		State of Pennsylvania	A. J. Mann.
Virginian	M. Fitt.	Am. s. s. Advance	Jas. R. Beers.	State of Nebraska	A. G. Braes.
<b>Mallory Line.</b>		Merrimack	Wm. Weir.	Switzerland	H. Buschmann.
Am. s. s. Alamo	Sam. Riek.			St. Laurent	M. de Jouselin.
Colorado	Jas. Daniels.			W. A. Scholten	G. J. Vis.
Laupapas	M. B. Crowell.			Westernland	Com. W. G. Handie.
Rio Grande	Jas. F. Lewis.				
San Marcos	A. C. Burrows.				

# MONTHLY WEATHER REVIEW.

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No. 12.

## INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during December, 1885, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i.

The paths of the centres of ten areas of low pressure are traced on the chart for December, 1885, the average number for that month during the last twelve years being 12.6.

The month was warmer than the average in all districts west of the Mississippi River, except in the west Gulf states, where the temperature was normal; in the south Atlantic and east Gulf states the month was colder than the average; in the northern districts east of the Mississippi River the departures were slight, though generally above the normal temperature.

The rainfall was below the average over the greater part of the country, the deficiencies being greatest in the Ohio Valley, Tennessee, west Gulf states, and north Pacific coast region. Along the Atlantic coast, south of New England, the precipitation was above the average, the excess being greatest on the south Atlantic coast.

With this REVIEW are published two additional charts, numbers v and vi. The former exhibits the annual isotherms for 1885, and the departures from the normal temperature; the latter shows the annual precipitation for the same year.

In the preparation of this REVIEW the following data, received up to January 20, 1886, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and eighteen Canadian stations, as telegraphed to this office; one hundred and sixty-one monthly journals and one hundred and sixty-three monthly means from the former, and eighteen monthly means from the latter; two hundred and ninety monthly registers from voluntary observers; forty-four monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the New England Meteorological Society, and from the local weather services of Alabama, Indiana, Iowa, Minnesota, Missouri, Nebraska, Ohio, and Tennessee, and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

## ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The mean atmospheric pressure for December, 1885, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The mean pressure for the month is greatest over the central Rocky Mountain districts and least over the Canadian Maritime Provinces. Over the first mentioned region the barometric means generally range from 30.2 to 30.3, while over the latter they fall to 29.9, or slightly below. The mean pressure exceeds 30.1 over nearly the entire country, the exceptions being the northern and southern Pacific coast regions and over the northern part of the country to the east of the Mississippi River. In eastern Tennessee and the Gulf States, except southern Texas, the mean pressure is slightly in excess of 30.15.

A comparison with the mean pressure for the preceding month shows an increase over the entire country, with the exception of the Canadian Maritime Provinces, where a slight decrease has occurred. The greatest difference is shown on the north Pacific coast, where the barometric means are from .20 to .25 higher than for November. Over the Rocky Mountain districts the difference ranges from .01 to .10, and over the central and southern districts to the eastward it is slightly in excess of .10.

The departures from the normal pressure at the various Signal Service stations are given in the tables of miscellaneous meteorological data, and on chart iv they are exhibited by lines connecting stations of equal departure. In the Gulf States, central and southern Rocky Mountain districts, and on the Pacific coast, the mean pressure is above the normal, the departures not exceeding .10, except at Santa Fé, New Mexico, where it amounts to .11. Over the northern districts to the east of Washington Territory, and over the central portions of the country east of the Rocky Mountains, the pressure is below the normal, the departures being most marked in New England and portions of the lower lake region and middle Atlantic states, where they range from .10 to .12.

## BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the tables of miscellaneous data. They were greatest in New England and least in the southern portions of Florida and California.

The following are some of the extreme ranges:

Greatest.	Least.
Inches.	Inches.
Eastport, Maine.....	San Luis Obispo, California.....
Portland, Maine.....	Key West, Florida.....
Boston, Massachusetts.....	Los Angeles, California.....
Albany, New York.....	Sanford, Florida.....
Oswego, New York.....	Fort Grant, Arizona.....
Block Island, Rhode Island.....	Cedar Keys, Florida.....
New Haven, Connecticut.....	Yuma, Arizona.....
Buffalo, New York.....	Fort Apache, Arizona.....
Erie, Pennsylvania.....	Prescott, Arizona.....

On the north Pacific coast, and in all districts east of the Rocky Mountains to the north of the thirty-fifth parallel, the monthly ranges exceeded 1.00.

## AREAS OF HIGH PRESSURE.

Six areas of high pressure were traced from the Rocky Mountain regions to the Atlantic coast after the 6th of the month; previous to that date the high area, which had formed



over the northern and central plateau regions during the latter portion of November, remained almost stationary, the pressure ranging from 30.30 to 30.60. The general direction of progressive movement of these areas was to the southeast until they reached the Atlantic coast, where the course changed to east, or slightly to the north of east.

I.—This high area formed north of Dakota on the morning of the 6th, and probably resulted from the easterly movement of the area, previously referred to, extending over the northern plateau region; this last-named condition disappeared before the advance of the low area from the north Pacific coast. The weather chart of the morning of the 6th exhibited a well-defined storm-centre about one thousand miles to the southeast, and a second slight depression about the same distance to the west of this high area. After the advance movement had set in from the extreme northwest the rate was about fifty miles per hour, while the low area continued its easterly course at the rate of twenty-five miles per hour. The pressure ranged from .2 to .3 above the normal within this area, and it increased after reaching the Atlantic coast; it moved directly east from the Ohio Valley during the 7th, and inclined to the northeast after passing the coast line. No unusual change of temperature occurred during the transit of this area over the United States, although it was from 20° to 30° below the normal for the month near the line of greatest pressure.

II.—The pressure increased in the northern and central Rocky Mountain regions on the 9th, and continued above normal during the 10th; it was .3 above the normal in the Mississippi Valley, and .3 to .4 above the normal from Montana westward to the Pacific coast on the morning of the 11th, when this area extended from the north Pacific coast southward to the Gulf coast. The morning weather chart of the 11th indicated that this area of high pressure had three distinct centres, one in the east Gulf, one in the lower Missouri valley, and one in Montana, the pressure being greatest in the last-named. The morning reports of the 11th showed an easterly movement of these areas after uniting, forming a well-defined single area extending over the central valleys; this area extended from the Atlantic coast to the north Pacific coast on the 11th, and was attended by generally fair weather, except in the Lake regions and the southern Rocky Mountain stations, where light snows occurred. It moved eastwardly, with increasing pressure, during the 12th, and a trough of low pressure extended from Texas to Manitoba, apparently dividing this extended area, leaving the barometer from .3 to .4 above the normal over the Pacific coast and plateau regions. As it approached the coast the pressure increased from 30.50 to 30.70, the area became less extended and the bounding isobars more uniform in curvature, the gradients being greatest in the southwest and northeast quadrants; the area moved to the northeast after passing over the middle Atlantic states, and was quickly followed by general rains or snows in all districts east of the Mississippi during the 12th and 13th; this precipitation resulted from the storm that moved northeastwardly from the west Gulf coast. A light "norther" occurred on the Texas coast before the union of these three areas previously referred to, and killing frosts occurred as far south as San Antonio, Texas, on the 10th.

III.—When the previously-described area passed off the Atlantic coast, this area extended over the north Pacific coast, the two being separated by a storm of considerable energy, which was moving northward from the Gulf coast. During the 13th the pressure increased over the upper Missouri valley, the line of greatest pressure extending southwestward from Manitoba to southern California; during the same date the storm from the Gulf coast moved rapidly northward to the Lake region, causing general rain or snow. During the northward movement of this low area there was a rapid movement of translation in the area of high pressure from the upper Missouri valley to the west Gulf states, and the cold attending these changes caused killing frosts as far south as Indianola, Texas, and the Rio Grande Valley on the morning of the 14th; the

barometer was 30.52 at Rio Grande City, Texas, on this date, while a secondary high area remained over the central plateau region. The pressure increased over the Southern States along the Gulf coast during the 14th, attended by cold and freezing weather throughout the Gulf and south Atlantic states; by the morning of the 17th this area had disappeared to the eastward of the south Atlantic coast.

IV.—This high area appeared north of Minnesota on the 15th, and moved rapidly eastward north of the Lake region during the 16th, causing a slight cold wave in the Saint Lawrence Valley and New England. At midnight of the 17th it was central in the lower Saint Lawrence valley, where the pressure was .5 above the normal. Light snows occurred on the New England coast and westward over the lower lake region as this area moved eastward. On the morning of the 18th it extended over the Maritime Provinces, where the temperature ranged from -16° to +20°. This area disappeared rapidly to the east of Nova Scotia during the 18th.

V.—This area formed slowly over the southern Rocky Mountain region during the 17th, while a low area moved northward from the Pacific coast region to Manitoba; it extended slowly northward and eastward during the 17th, covering the entire Rocky Mountain regions during the 17th and 18th, the movement being in the direction of the area of low pressure previously referred to; it extended over the Saint Lawrence Valley during the 19th and 20th, accompanied by fair weather, and with temperatures generally above normal. The pressure continued high in the Southern States and in the southern Rocky Mountain region during the 20th and 21st, with warm, fair weather, while this area moved southeastward to the south Atlantic coast and disappeared.

VI.—As in the previous area described, the pressure gradually increased in the southern and central Rocky Mountain regions, and there was a gradual rise in the barometer on the 22d and 23d, resulting in the formation of this extended area of high pressure within the limits of the stations of observation. The area extended northeastwardly, and the pressure was greatest in northern Minnesota at midnight of the 24th, the line of greatest pressure extending northeast and southwest, while there were indications of low areas existing east of the south Atlantic coast and the north Pacific coast. It was central north of the lake region at midnight of the 25th, the southwest half of this area covering the greater portion of the United States east of the Rocky Mountains; the gradients were increased rapidly to the westward, owing to the advance of the low area from the Pacific coast; they also increased rapidly to the southward, owing to the northerly movement of the storm-centre east of the south Atlantic coast. Dangerous northeast gales occurred from Boston, Massachusetts, southward to Wilmington, North Carolina, on the morning of the 26th, the temperature ranging from 20° to 30° below the normal, and from 0° to -15° in the Saint Lawrence Valley when the pressure reached its maximum in this region on the 26th. The rapid movement northward of the storm on the Atlantic coast apparently prevented the further movement of this area to the eastward, and the gradients increased on the middle Atlantic coast, causing violent gales on the 26th and 27th, while the high area moved southwestward from the Saint Lawrence Valley to the Ohio Valley and the east Gulf states, the pressure during this movement diminishing from 30.80 to 30.30; during the 28th and 29th the area disappeared by a gradual fall of the barometer, without any apparent movement of translation.

A slight area of high pressure formed in the Rocky Mountain region on the 29th, but disappeared without extending over the regions to the eastward.

#### AREAS OF LOW PRESSURE.

Ten areas of low pressure have been traced over the United States, or near the limits of the stations of observation, during the month; five low areas either originated in British America, north of the territories, or on the north Pacific coast; two



passed from the Southwest to the Lake region; two moved northward along the Atlantic coast east of Cape Hatteras, North Carolina, and one was a secondary area which developed in the Lake region when the principal area was central in the extreme northwest. With the single exception of number i, these areas all passed north of the Saint Lawrence Valley. The mean latitude of these areas was north of the latitude of the normal storm-tracks for December, and they were also north of the mean latitude of the storm-tracks of the preceding month; the average direction was more directly to the northeast, after passing the Mississippi Valley, than the average direction of the areas for November.

The following table shows the latitude and longitude in which each low area was first and last observed, and the average rate of movement:

Low areas.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I .....	30 00	77 00	34 00	74 00	12.0
II .....	54 00	90 00	49 00	58 00	30.0
III .....	53 00	112 00	52 00	64 00	40.0
IV .....	48 00	82 00	46 00	71 00	30.0
V .....	34 00	100 00	50 00	73 00	35.0
VI .....	27 00	100 00	48 00	71 00	48.0
VII .....	52 00	99 00	49 00	64 00	30.0
VIII .....	53 00	101 00	52 00	60 00	40.0
IX .....	.....	.....	49 00	60 00	22.0
X .....	37 00	102 00	49 00	77 00	38.0
Mean hourly velocity .....					31.5

I.—The month opened with this area central off the south Atlantic coast, while a second low area was moving north of Dakota, and an extended high area covered the Rocky Mountain regions. This low area was at no time within the limits of the stations of observation, but reports from the coast stations serve to enable us to trace the northerly movements during the 1st and 2d. Light rains and brisk to high northerly winds, backing to northwesterly, were reported from the middle and south Atlantic states during the 1st and 2d. This storm either passed east of Cape Hatteras, North Carolina, or formed a secondary disturbance which became part of the low area which was moving eastward over the Saint Lawrence Valley on the 3d. Severe gales occurred northeast of the Nova Scotia coast, indicating that a union of these depressions did not occur until after both had passed eastward over the Atlantic.

II.—As previously stated, this low area was central north of Dakota at the morning report of the 1st. It probably originated on the north Pacific coast and moved eastward far to the north of the stations of observation, as the high area which covered the Rocky Mountain region remained almost stationary during its transit over the Rocky Mountains. This storm moved eastward, inclining southward towards the Saint Lawrence Valley, the pressure decreasing rapidly at its centre during the advance, and when it reached the latitude of Quebec, Province of Quebec, the barometer had fallen to 29.09 at the centre. Strong northwesterly winds prevailed in the Lake regions, and light snows were reported in New England, New York, the lower lake region, and the Saint Lawrence Valley. On the 3d the barometer was lower to the east of Sydney, Nova Scotia, indicating the existence of a second depression near the coast over the Atlantic, and it is probable that this latter disturbance is identical with that previously traced as number i off the south Atlantic coast. This storm reached the most southerly point of its track when central near Quebec, Province of Quebec, on the 3d, after which it moved east and northeast, extending in area, and the pressure continued to decrease, the barometer reading as low as 29.02 at Bird Rock, Gulf of Saint Lawrence, on the morning of the 4th; strong westerly gales continued in the Maritime Provinces on the 4th, with rapidly increasing pressure, indicating that the storm had passed to the east of the station.

III.—This low area was probably central on the British American coast when the preceding storm was north of the Lake region; it crossed the Rocky Mountains north of Montana, and without causing any marked change within the high area then covering the Rocky Mountain districts; its course was more to the southeast than that of the preceding areas; while they moved over nearly parallel tracks, number iii entered the United States near the Montana line and moved southeastward, with increasing energy; it was central near Saint Paul, Minnesota, at midnight of the 3d, while number ii was central near Father Point, Province of Quebec; the southeast course continued until the centre reached southern Michigan, when the course changed; the storm followed the lower lake region and the Saint Lawrence Valley and passed beyond the stations of observation. This storm was unusually severe in the west quadrants on the 4th and 5th; the gradient was rapid to the west and also to the east; after the centre reached New England, it was followed by a cold wave which was most severe in the Northwest, and caused general snows in the Northern States and as far south as the Gulf and south Atlantic states on the 4th and 5th, and severe gales occurred on the coast from Jacksonville, Florida, northward to Sydney, Nova Scotia, and in the lower lake region; a dry "norther" occurred in Texas on the 5th. Signals were displayed, giving ample warning of the advance of this storm.

The following notes from observers, relative to this storm, are of interest:

Buffalo, New York: a violent snow storm occurred on the 5-6th, the wind reaching a maximum velocity of forty-eight miles per hour; signs, trees, fences, and out-buildings suffered from the gale; trains from all directions were delayed; on Lake Erie the storm was unusually severe. The warnings gave entire satisfaction to all interested, being timely, and fully justified; no vessel left port, and the compliment to the service is all the more great, as many of the largest steamers were ready to sail when the cautionary signal was displayed.

Cleveland, Ohio: a heavy snow storm, accompanied by high winds, occurred on the 5th and 6th.

Sandusky, Ohio: the severest gale of the season occurred on the 5th, continuing into the 6th, the wind reaching a maximum velocity of fifty-six miles per hour. The signal display caused three heavily-laden vessels to remain in harbor that would probably have been lost.

Grand Haven, Michigan: a high westerly gale, pronounced by vesselmen to have been the worst storm ever experienced on the Lakes, occurred on the 4th and 5th.

Detroit, Michigan: a heavy northwest gale prevailed on the 5th and 6th, unusual in severity, with the temperature 5° to 10° below zero; several vessels have been wrecked, and great damage done to shipping interests on the Lakes.

Chicago, Illinois: a snow storm of unusual violence occurred on the 4th, the wind blowing a heavy gale from the northwest; Lake Michigan was very rough, the heavy sea causing great destruction of property along the shore; many vessels remained in harbor, and mariners consider the timely warning was the means of saving a large amount of property.

Milwaukee, Wisconsin: an unusually heavy gale occurred on the 4-5th, the wind reaching a velocity of forty-four miles per hour; the water-works pier was partially, and the breakwater entirely, destroyed; the damage was quite severe along the shore and for a considerable distance into the interior.

Port Huron, Michigan: a violent gale, accompanied with heavy snow, occurred on the 4th and 5th, the wind reaching a velocity of thirty-nine miles per hour at 5.20 a. m. of the 5th; considerable damage was done by the wind.

Mackinaw City, Michigan: a severe gale began at 12.15 a. m. of the 4th, continuing throughout the day; the warning of the cold wave included in the order to hoist cautionary signal was of great benefit to merchants, railroad agents, etc.; the Michigan Central railroad, by the timely warning, saved a car load of potatoes from freezing.

Erie, Pennsylvania: a heavy northwest gale occurred on the 6th, accompanied by heavy snow, the wind reaching a maximum velocity of forty-four miles per hour; considerable damage was done along the beach.

Smithville, North Carolina: a heavy southwest gale began at 11.30 p. m. of the 4th, and continued until the afternoon of the 5th, the wind reaching a velocity of forty-one miles per hour. Two wharves were washed away along the town front, and the schooner "Rebecca H. Queen" was driven ashore near New Inlet, North Carolina; the probability of saving vessel or cargo doubtful. The schooner "Paragon," from Charleston, South Carolina, bound to Washua, North Carolina, sank during this gale, sixty miles off Cape Fear, North Carolina. Many vessels heeded warning and remained in harbor.

Racine, Wisconsin: the storm of the 4th was the most severe that has been experienced in this vicinity for several years. Considerable damage was done to the piers and lake shore protections.

Cairo, Illinois: the high wind of the 4th, which accompanied the cold wave, was very destructive to navigation between here and Paducah, Kentucky; sev-

eral large produce boats were dashed to pieces. Sixteen miles north of this city a large produce boat, loaded with potatoes, was completely wrecked, and six of the crew drowned. The river men took timely warning from the afternoon bulletin, which pre-announced the cold wave and high wind, and all river craft were made doubly secure. The produce merchants took precaution to prevent the freezing of perishable goods, and suffered no loss. The cold-wave warning was a decided benefit, and highly appreciated by the entire community.

Sand Beach, Huron county, Michigan: the worst storm in twenty years occurred on the 5th, the whole protection wall of the harbor breakwater was washed away and a breach of five hundred feet formed in the main wall. Great damage was also done to the shipping interests.

Louisville, Kentucky: a severe gale commenced at 6.45 p. m. of the 4th and continued throughout the evening. Considerable damage was caused by the wind. Falling signs, shutters, etc., made travel on the streets dangerous, and several slight casualties are reported. On the river front much difficulty was experienced in holding vessels to their moorings.

Vermillion, Dakota: a very heavy wind prevailed on the 4th, doing considerable damage to buildings in this vicinity.

Farmingdale, Bledsoe county, Tennessee: at 11.30 p. m. of the 4th a furious wind storm, from the northwest, suddenly came on and, for five minutes, blew with great force, breaking down considerable timber in the forests.

Saint Louis, Missouri: a very high wind prevailed here on the 4th. Considerable damage was done in various parts of the city.

Kansas City, Jackson county, Missouri: one of the severest wind storms ever experienced at this place occurred on the 4th; considerable damage was done to movable property.

Carthage, Jasper county, Missouri: the highest wind known for years began on the 3d, and continued without intermission for thirty hours.

Wichita, Sedgwick county, Kansas: a heavy gale occurred on the 4th, doing considerable damage to buildings; vehicles were overturned in the streets, and chimneys blown down.

Concordia, Cloud county, Kansas: a destructive wind storm occurred on the 4th, unroofing buildings, blowing down chimneys, out-buildings, etc.

Leavenworth, Kansas: a heavy gale occurred on the 4th, doing considerable damage to property in the city.

Elk Falls, Elk county, Kansas: a severe gale on the 4th unroofed buildings, and caused serious damage.

Independence, Montgomery county, Kansas: a strong gale occurred on the 4th, which caused considerable damage to hay-stacks; several small houses were blown over.

Omaha, Nebraska: the severest wind storm in the history of this city occurred on the 4th; at least fifty houses were partially or wholly unroofed and miles of fencing prostrated; the damage is estimated at \$15,000 to \$20,000.

Stockham, Hamilton county, Nebraska: a heavy wind, causing serious damage to wind-mills, houses, and other property, occurred on the 4th.

Harvard, Clay county, Nebraska: a high wind on the 4th blew down wind-mills and other buildings.

Central City, Gilpin county, Colorado: from 7 to 9 p. m. of the 4th a violent wind prevailed, doing a great deal of damage.

IV.—When the low area, previously described, was moving over the Saint Lawrence Valley, a secondary storm-centre developed north of Lake Huron, causing the storm of the 4th to continue until after the 6th. The barometer, although unusually low, in this secondary area was still lower, being below 28.80 within the principal area, which was north of the Maritime Provinces on the 6th, while this depression moved across the upper Saint Lawrence valley and disappeared to the northeast, causing severe gales on the 7th and 8th, at the northeast Canadian stations and on the New England and middle Atlantic coasts.

V.—This storm probably developed on the north Pacific coast, or over the north plateau region, although it is not possible to trace it further to the west than northern Texas; it moved slowly eastward to the central Mississippi valley during the 8th, and the trough of low pressure extended northward to the Lake regions, while high areas covered the Atlantic and central Pacific coasts; the area of precipitation included all districts east of the Rocky Mountains. General rains fell in the east and south quadrants, followed by snow when the cold wave, which followed, passed over these districts; the direction of movement was almost directly north until the centre passed over Lake Huron, when it apparently changed to northeast, and disappeared during the 10th. This storm was severe in many localities, and attained its maximum energy while passing over the upper lake region on the 9th. The strongest wind occurred on Lake Michigan, in the southwest quadrants. The observer at Grand Haven, Michigan, reports as follows, relative to this storm: "A heavy southerly gale, having an average velocity of forty-eight miles per hour, occurred on the 9th;

very heavy seas swept the piers, doing great damage; the outer lighthouse was moved fifteen feet from its foundation, and turned half way around."

VI.—This storm had its origin in the Southwest, although there are indications that it may have originated further to the west, or in the south Pacific coast region. On the morning of the 12th an extended high area covered the region east of the Mississippi River, and a high area also covered the Pacific coast, while this low area was apparently forming in southern Texas, the pressure being .3 to .4 above the normal for the month. The high pressure already described in the east, extended westward over this region. The general distribution of pressure, the succeeding movements of the high and low areas, and the track of this low area, are very similar to the corresponding conditions attending the preceding storm, with the exception that this storm passed from southern Texas to the lower lake region over a course east of, and nearly parallel to the track of, the preceding storm. Rain or snow occurred in all districts during the passage of this area, and it was followed by a cold wave which caused freezing weather throughout the Southern States on the 14th and 15th. It was severe on the Atlantic coast, where signals announced the approach of this storm in ample time to prevent loss. The observer at New London, Connecticut, reports that the gale was unusually severe on the 13th, and that the harbor was full of shipping, none of which left during the display of the signal. This disturbance lost much of its energy while passing over the Saint Lawrence Valley, and the area became more extended, but the barometer remained low at stations northeast of New England on the 16th.

VII.—This storm was probably central on the north Pacific coast on the 16th, where general rains were reported from San Francisco, California, northward. The depression passed eastward rapidly, leaving the barometer high at the central Rocky Mountain stations, but it could not be definitely located until the 10 p. m. report of the 17th, when it was north of Manitoba. From this point the storm moved southeasterly, crossing over the northern portion of Lake Superior and the upper Saint Lawrence valley to the New England coast, where its course changed to the northward, and disappeared on the 21st. It was severe near the centre of disturbance after it reached the lower lake region. The pressure decreased near the centre as it approached the coast, but its maximum energy occurred some time before the barometer reached its minimum.

VIII.—The barometer was low on the Pacific coast, accompanied by general rains, previous to the appearance of this area in Manitoba on the 21st. The barometer was high at the southern stations, the centre of greatest pressure being in the east Gulf states, while it was low on the northern boundary of the United States from the Saint Lawrence Valley to Oregon. As this storm approached Lake Superior, light rains occurred in the adjoining districts on the 22d and 23d. It developed considerable energy before its course changed to the northeast on the 23d, after which it decreased in energy. The most southerly point of its course was reached when its centre was near Lake Huron.

IX.—This storm probably had its origin far to the south of the point marked as its centre on the 26th. Its course was almost directly north, while passing sufficiently near the coast to render it possible to approximately locate its centre at each of the tri-daily telegraphic reports. The high area over the eastern portion of the continent at the time this storm was moving northward, east of the coast, caused a very rapid increase in the gradient, and the gales resulting were unusually severe, as shown from reports of the observers on the coast. The advance of this storm-centre to the north apparently changed the course of the movement of the high area to the west, causing it to move southward and disappear by a gradual diminution of pressure, as previously described.

The following notes and reports of observers refer to conditions attending this storm.

Kitty Hawk, North Carolina: a northerly gale occurred on the 25th, con-



tinuing throughout the 26th, the wind reaching a maximum velocity of sixty-five miles per hour, and averaging 50.7 miles for the entire twenty-four hours.

Cape Henlopen, Delaware: a severe northeast gale, with heavy drifts of sand, occurred on the 26th; several casualties to shipping are reported.

Chincoteague, Virginia: a very heavy gale occurred on the 26th, the wind attaining a velocity of fifty-four miles per hour; many vessels remained in harbor during the signal display.

Block Island, Rhode Island: a violent northeast gale occurred on the 26th, continuing throughout the 27th, the wind reaching a maximum velocity of sixty miles per hour; several casualties to shipping are reported.

Boston, Massachusetts: the most severe gale that has been experienced for several years occurred on the 26th. Many wrecks are reported, and considerable damage was done along the coast.

Eastport, Maine, a heavy gale, attended with snow and sleet, began at 5.50 a. m. of the 26th and continued for thirty-two hours, the wind reaching a maximum velocity of forty-three miles per hour. Three steamers and thirty-one schooners remained in port; several wrecks are reported within a radius of twenty-five miles.

Portland, Maine: the gale of the 26th was very disastrous along the coast; several wrecks were reported.

The following is an extract from the Charleston (South Carolina) "News and Courier":

Captain J. H. I. Donahoo, of the schooner "J. B. Atkinson," from Mobile Alabama, bound for New York City, reports that on the 25th, when about thirty miles north of Cape Hatteras, he encountered a terrific gale from the north-northeast, which carried away a portion of the rigging; the heavy sea washed away part of the deck-load and stove in the cabin. Had it not been for bags of oakum and oil, which were towed astern and broke the force of the waves, the vessel would probably have been lost. Several of the crew were badly injured.

X.—This depression was first marked as central in the central Rocky Mountain region, although it apparently resulted in the barometric depression existing to the southward and was probably urged to the eastward by the high area then existing to the north and west, the course of the low area being to the northeast over the upper lake region during the 29th and 30th; when it passed to the Mississippi Valley it was elongated in a north and south direction, but the bounding isobars rapidly contracted while advancing towards the Lake region. The rainfall was general, but light, except near the centre. On the morning of the 31st a secondary depression developed in the middle Atlantic states, which moved rapidly along the coast to the northeast, increasing gradually in energy, and forming the principal feature of the storm, while the primary disturbance lost energy, and finally united with the secondary depression, which passed along the New England coast and disappeared over the Atlantic after the close of the month.

#### [NORTH ATLANTIC STORMS DURING DECEMBER, 1885.]

[Pressure expressed in inches and millimetres; wind-force by scale of 0-10.]

The tracks of the areas of low pressure that have appeared over the north Atlantic Ocean are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and special reports collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data, received at this office up to January 22, 1886.

The paths of ten areas of low pressure are shown on the chart for December, 1885. Of these, four, viz., numbers 4, 5, 8, and 10, are continuations of low areas which entered the Atlantic from the Gulf of Saint Lawrence, having previously passed over the United States and Canada; one, number 3, is a continuation of an area of low pressure which developed near the coast of Florida on the 1st, and which caused moderate to strong gales at stations on the south Atlantic coast before passing out to sea. One, number 9, was a storm which developed suddenly on the 19th, near N. 42°, W. 59°; it moved northeastward, and probably united, when northeast of Newfoundland, with number 10. The remaining low areas, numbers 1, 2, 6, and 7, apparently developed over the ocean

east of the fortieth meridian and between N. 45° and 55°. The general direction of movement of the storm-centres was north-easterly or east-northeasterly, except in the case of number 4, which, on reaching W. 25°, was forced to the southeast and south by the formation of an area of high pressure over the British Isles and over the ocean north of the fiftieth parallel.

The weather over the north Atlantic Ocean during December, 1885, was stormy and unsettled. During the first week the pressure was generally low; about the 7th an area of high pressure appears to have formed over mid-ocean, and this continued, with slight fluctuations, until the 13th, when it was replaced by areas of low pressure over the region east of 40° W. The pressure over mid-ocean remained comparatively low during the period from the 13th to about the 19th, while areas of high pressure appeared off the American and European coasts. From the last-mentioned date until the close of the month pressure was generally high over the region between the Banks and the European coasts, and low near the coasts of the United States.

The following are descriptions of the low areas charted:

1.—This area of low pressure appeared between W. 30° and 25°, and near N. 50°, on the 1st. On that date the s. s. "Aurania," W. H. P. Hains, commanding, in N. 50° 03', W. 25° 30', at noon (Greenwich time), reported barometer 29.76 (755.9), wind ssw., force 7, and on the same day, about five hours later, in N. 49° 46', W. 27° 20', the barometer had fallen to 29.46 (748.3), and the wind had increased to a whole gale from ssw., shifting suddenly to w. Captain Hains also reported: "The gale had been blowing steadily from ssw. for half an hour before the shift; lightning flashed out from wnw., with thunder and torrents of rain; the gale moderated towards midnight." Vessels to the westward of the "Aurania," as far as W. 40°, had pressure ranging from 29.6 (751.8) to 29.9 (759.4), with moderate gales or strong breezes from n. and nw. This area moved northeastward, and on the 2d it was apparently central off the northwestern coast of the British Isles, with pressure at the centre less than 29.6 (751.8).

2.—This area of low pressure first became well-defined on the 3d, when the centre was near N. 51°, W. 22°, but it had apparently existed as a depression on the preceding day farther to the westward, and at a lower latitude, as indicated by the following reports: The s. s. "Coventry," W. C. Bacon, commanding, in N. 44° 30', W. 43° 58', on the 2d, had barometer 29.98 (761.5), being a fall of about .4 inch since the observation of the 1st, wind ne., force 7, shifting to a heavy gale from se. at midnight, and continuing until 9 a. m. of the 3d. The bark "Livingstone," in N. 45° 0', W. 37° 30', on the 2d, reported heavy gales, from sw. to n., in which she lost and split sails, and sustained other damage. On the 3d the storm-centre was near N. 51°, W. 22°, with the barometer below 29.0 (736.6), and attended by gales of force 8 to 10 in all quadrants. On the 2d, Captain A. McRitchie, commanding the s. s. "Australia," in N. 49° 10', W. 29° 59', at noon (Greenwich time), reported: "Moderate breeze and cloudy, wind variable; 2 p. m., wind increasing from sse., with rain; 6 p. m., moderate to fresh breeze, with heavy rain-squalls, sea very much confused; 10 p. m., strong breeze, from e. by s., with very heavy rain; 11.30 p. m., wind hauling to sw., with continuous heavy rain; midnight, fresh gale; at 8 a. m. on the 3d, hard gale, with very high sea; 9.40 a. m., moderate gale, rain; 10 a. m., wind veering to nw. and blowing with hurricane force, sea high, ship laboring heavily, and shipping heavy seas; noon, 13th, in N. 49° 17', W. 24° 20', barometer 29.13 (739.9), wind nw., force 10." The s. s. "Lessing," B. Voss, commanding, in N. 49° 6', W. 25° 30', at noon (Greenwich time), on the 3d, had barometer 29.68 (753.9), wind nw., force 9. During the afternoon of the 2d the wind shifted from s. to nw., through e., the barometer falling, between midnight of the 2-3d and 4 a. m. of the 3d, from 29.23 (742.4) to 29.14 (740.1), accompanied by heavy nw. gale, with rain; at 6 a. m. on the 3d the barometer began to rise. Captain W. Fitt, commanding the s. s. "Brooklyn City," furnishes the following report (the barometer, aneroid, is corrected):

December 3.	Wind.		Barometer (aneroid).		Lat. N.	Long. W.
	Direction.	force.	Inches.	Mill.		
H. M. (Greenwich mean time.)						
00 00 a. m.	e.	8	29.71	754.6	50 48	74 45
2 00 a. m.	ese.	10	29.01	739.8	50 48	74 20
5 30 a. m.	s.	9	28.91	734.3	50 50	73 38
9 30 a. m.	sw.	8	28.91	734.3	50 50	72 46
11 00 a. m.	hw.	10	29.01	739.8	50 50	72 35
0 30 p. m.	hw.	10	29.11	739.4	50 50	72 33
3 00 p. m.	hw.	8	29.31	744.5	50 00	72 30
5 20 p. m.	hw.	8	29.41	747.0	50 48	72 00
12 00 p. m.	wnw.	8	29.71	754.6	50 48	70 45

Captain Fitt remarks as follows: "At about 10 a. m. the wind lulled for half an hour; the sea was very much confused, and leaped as high as the funnel, one sea breaking on board and smashing a life-boat to pieces. Shortly after, the wind came from nw. and increased to hurricane force; the air was a mass of spray and foam, and we could scarcely see the length of the ship." The s. s. "Denmark," Geo. Cochrane, commanding, in N. 49° 44', W. 21° 08', had barometer 28.99 (736.3), at noon on the 3d, wind veering from s. to sw., w., and nw., and blowing with the force of a whole gale. The steamers "City of Richmond," "Australia," (Ger.) "Neckar," and "Rhaetia," between N. 49° 50' and N. 51° 23', and from W. 11° 30' to W. 20° 10', reported barometer ranging from 29.12 (739.6) to 29.45 (748.0), and all encountered gales of force 9 from s. to sw., w., and nw. Captain Pearce, commanding the bark "Exile," in N. 48° 45', W. 22° 20', at noon (Greenwich time) on the 3d, reported: "1 a. m., strong sw. by w. wind, barometer 29.62 (752.3); 4 a. m., heavy gale, barometer 29.42 (747.3); 8 a. m., terrific gale, with very high sea, barometer 29.22 (742.2), wind hauling to westerly; 10 a. m., wind flew into nw., blowing a hard gale, barometer rising; noon, hard gale, but moderating, barometer 29.32 (744.7)." During the 3d this low area moved northeastward, and on the 4th it was apparently central over the northern part of the British Isles, where the pressure was less than 29.15 (740.4), and moderate to strong sw. and w. gales were prevailing in those islands and over the adjacent seas.

3.—This is a continuation of the low area referred to as number i under "Areas of low pressure" in this REVIEW. On the 2d the storm-centre was between Bermuda and the coast of the Carolinas, causing strong n. and nw. gales along the Atlantic coast, and equally strong e. and ne. gales from the Banks of Newfoundland to the New England coast. On the 3d the storm-centre was shown near N. 43°, W. 56°, where the pressure was less than 29.0 (736.6), and strong gales prevailed in all quadrants of the depression, extending over the ocean eastward to the forty-fifth meridian, and westward and southward to the coast of the United States. At midnight of the 2d the s. s. "Wells City," T. L. Weiss, commanding, had a strong gale from se., shifting to s. and w. during the 3d; the lowest barometer was 29.19 (741.4), at midnight of the 2d, in N. 42° 6', W. 62° 57'. The s. s. "York City," E. W. Benn, commanding, in about N. 43°, W. 58°, at midnight of the 2d, had a heavy se. gale, which continued until 4 a. m. of the 3d, when the wind shifted to sw., and at 5 a. m. to wnw., blowing a heavy gale. On the 3d the s. s. "Assyrian Monarch," John Harrison, commanding, reported, at 4.15 a. m. (Greenwich time), wind freshening from se., barometer falling rapidly; noon, in N. 45° 20', W. 53° 15', barometer 29.10 (739.1), wind se., force 7; 3.30 p. m., wind shifted to sw.; 6 p. m., barometer was at its lowest reading, 28.92 (734.6), wind w., and blowing with hurricane force; 7.30 p. m., wind hauling to wnw., and moderating, barometer rising rapidly. The s. s. "Celtic," B. Gleadell, commanding, in N. 45° 45', W. 51° 42', at 2.30 p. m. on the 3d, had barometer down to 28.92 (734.6), strong gale from se., veering to wnw. The s. s. "Rosie," Jas. Dixon, commanding, in N. 42° 55', W. 55° 34', had a hard gale from ese. to s., w., and nw.; the lowest barometer was 29.01 (736.8), at 9.45 p. m. (Greenwich time) on the 3d. Strong gales from se., veering to s. and sw., were reported by vessels to the eastward as far

as the forty-fifth meridian, the barometer ranging from 29.2 (741.7) to 29.6 (751.8).

During the 3d the storm-centre moved rapidly northeastward, and by the 4th it was near N. 50° and between W. 35° and 40°. On that date the s. s. "State of Pennsylvania," A. Mann, commanding, reported barometer 28.92 (734.6), at 4 a. m., in N. 50° 20', W. 39° 40', wind se., backing to e., ne., n., and nw., and blowing with the force of a strong gale. At 4 a. m. of the 4th the s. s. "Nevada," J. Douglass, commanding, had barometer down to 29.12 (739.6), in N. 48° 33', W. 40° 02', with a strong gale from se., shifting to ssw. and wsw. Strong w. gales, shifting to s. on the approach of low area 4, prevailed over the ocean west of the fortieth meridian, and the slight increase of pressure which had occurred after the passage of number 3 was checked. At the same time a moderately steep barometric gradient existed to the eastward of 40° W., so that strong s. winds to gales occurred between W. 40° and 20°. On the 5th this low area was off the Irish coast, the centre being near N. 50°, W. 14°, where the barometer read 29.0 (736.6), and unsettled weather and strong s. gales prevailed over the British Isles and the Channel. The s. s. "Brooklyn City," W. Fitt, commanding, in N. 51° 10', W. 12° 50', at noon (Greenwich time) on the 5th, had barometer 29.01 (736.8), wind se., force 7. The s. s. "Republic," P. J. Irving, commanding, in N. 51° 29', W. 14° 14', barometer 29.11 (739.4), wind ese., force 7. The s. s. "Lake Superior," Wm. Stewart, commanding, in N. 51° 30', W. 12° 0', reported barometer 29.08 (738.6), whole gale from e., veering to s. and sw., and then backing again to s., e., and ne. During the 5th this low area apparently passed eastward over the British Isles.

4.—This was a continuation of the low area described as number ii under "Areas of low pressure" in this REVIEW. On the morning of the 4th it was over the Gulf of Saint Lawrence with the barometer less than 29.0 (736.6) at the centre of disturbance. During the day it moved rapidly east-northeastward, attended by strong gales from s. to sw. and w. over the Banks and the ocean southward to the fortieth parallel. On the 5th the region of least pressure was shown near N. 50°, W. 35°, where the barometer was down to 28.6 (726.4). The s. s. "Circassia," A. Campbell, commanding, at noon of the 5th, in N. 50° 50', W. 37° 31', had barometer 28.69 (728.7), wind nne., force 9. The s. s. "Rhyndland," J. C. Jamison, commanding, reported barometer 28.45 (722.6), at 1 p. m. on the 5th, in N. 49° 57', W. 33° 10', hurricane from se. and s., shifting to nw. and n. During this date all vessels between W. 40° and 27°, and N. 48° and 51°, reported pressure ranging from 28.7 (729.0) to 29.0 (736.6); no readings exceeding the latter value.

On the 6th the storm-centre was near N. 50°, W. 25°, the pressure having increased about .4 inch, the lowest barometric reading reported being 28.85 (731.5). During this and the preceding day, strong gales from s. to nw. prevailed over the Atlantic from the American to the European coasts. During the 6th this low area was apparently forced to the southward. By the 7th the winds over the region between N. 50° and 52° and W. 10° and 20° had shifted to e. and ne., and blew with the force of a strong gale, while the pressure began to increase over the ocean north of 50° N. and over the British Isles. On the 8th the area of high pressures was well defined and of great extent, covering the ocean from the British Isles westward to the fortieth meridian and from N. 55° to 45°. At the same time the area of low pressure was apparently moving southward between the Azores and the coast of the Iberian Peninsula, and on the 8th and 9th the pressure was apparently lowest in the vicinity of Madeira.

5.—This was probably a continuation of the area of low pressure described as number iv under "Areas of low pressure" in this REVIEW. At midnight of the 7th the storm-centre was in Newfoundland, and by the following morning it had passed northeastward to about N. 50°, W. 47°, the lowest reported barometer on the 8th being 29.65 (753.1). During its passage over the Gulf this low area caused very strong gales over the ocean south of Nova Scotia and on the Banks



of Newfoundland. By the 9th it had reached N. 52°, W. 35°, the pressure having increased to 29.85 (758.2), and during the day it probably filled in; on the following day an area of high pressures occupied the ocean, extending apparently from the Banks of Newfoundland eastward to the European coasts.

6.—This low area appeared on the 12th between N. 50° and 55° and W. 30° and 40°. At midnight of the 11th the s. s. "State of Nebraska," A. G. Braes, commanding, had barometer 29.4 (746.7), wind sw., strong gale, in N. 50° 18', W. 40° 0', and at noon of the 12th the s. s. "Ethiopia," J. Wilson, commanding, reported barometer 29.37 (746.0), in N. 52° 51', W. 30° 03', wind sw., force 7. This depression moved northeastward with gradually decreasing pressure, and passed beyond the range of the observations during the 13th; on that date moderate sw. and w. gales prevailed over the region from the British Isles westward to the twentieth meridian, and from N. 50° northward to N. 55°.

7.—This low area appeared near N. 49°, W. 35°, on the 13th; during the 12th the s. s. "France," A. D. Hadley, commanding, in N. 45° 50', W. 35° 51', had barometer 30.0 (762.0), falling steadily, with strong ssw. breeze. On the 13th the s. s. "Baltic," G. Burton, commanding, in N. 48° 51', W. 37° 37', had barometer 29.56 (750.8), wind w. by s., force 4, having shifted from sw.; on the same date the s. s. "Persian Monarch," J. Watson, commanding, in N. 49° 58', W. 33° 18', had barometer 29.57 (751.1), wind ne., force 5, and the s. s. "France," in N. 46° 39', W. 30° 22', barometer 29.64 (752.8), wind s. by w., force 8. The reports for the 14th and 15th showed the existence of a large, apparently elongated, area of low pressure over the ocean between W. 35° and 18°, and stretching from about N. 40° northeastward to N. 55°; within this area the pressure ranged from 29.3 (744.2) to 29.7 (754.4), and moderate to fresh gales from se., e., and n. were reported. By the 15th the low area had apparently extended to the Azores, while high pressures occupied the Bay of Biscay and southwestern Europe.

8.—This was a continuation of the storm described as number vi under "Areas of low pressure" in this REVIEW. On the morning of the 15th the centre was over the Gulf of Saint Lawrence, with pressure about 29.3 (744.2), and attended by moderate to strong gales from s. to sw. and w. over the Banks and southward to 40° N. On the 16th the centre of the low area was near N. 53°, W. 40°, where the pressure was 29.35 (745.5), the barometric readings increasing to 29.65 (753.1) near the forty-sixth parallel. To the eastward of the storm-centre the winds were from s. to sw., blowing with the force of a moderate gale, and to the southward and westward they were from nw. and w., force 5 to 7. On the 17th the lowest readings were shown near N. 52° and between W. 30° and 35°, where they ranged from 29.53 (750.0) to 29.7 (754.4), while the wind did not, generally, exceed the force of a strong breeze. On the 18th the storm-centre, attended by moderate to strong breezes only, was shown near N. 52°, W. 25°, the lowest reported pressures being 29.4 (746.7) and 29.43 (747.5), with strong s. and se. winds to the eastward and northward of the above-mentioned position. This low area continued its easterly movement during the 19th, and by the following day it had apparently entered Ireland as a slight depression, with lowest barometer about 29.7 (754.4).

9.—This area appears to have developed over the ocean to the southeast of Nova Scotia, during the 19th, when the storm described as number vii under "Areas of low pressure" in this REVIEW, was moving northeastward over New England and the Canadian Maritime Provinces. On the 18th an area of high pressure occupied the Gulf of Saint Lawrence, Newfoundland, and the Banks, and apparently extended southward beyond the fortieth parallel. On the 19th the s. s. "Hugo," A. de Mugica, commanding, in N. 41° 52', W. 58° 48', at noon (Greenwich time), reported barometer 29.68 (753.9), being a fall of about .55 inch since the observation of the 18th, wind sse., force 7, cloudy and rainy; at 1.30 p. m. the wind was sw., and at 4 p. m. it was blowing a fresh gale from

wnw., barometer reading 29.59 (751.6); at 5 p. m., wind nnw., strong breeze, and at 11 p. m. the wind again shifted to sse., in a fresh breeze. The s. s. "Assyrian Monarch," John Harrison, commanding, in N. 41° 39', W. 59° 45', at noon (Greenwich time) on the 19th, had barometer 29.72 (754.9), being a fall of about .58 inch, wind nnw., force 8. The s. s. "Persian Monarch," J. Watson, commanding, passed in close proximity to the storm-centre on the 19th; that vessel, in N. 44° 21', W. 55° 01', at 7.10 p. m. (Greenwich time), had barometer down to 29.46 (748.7), the wind blowing a whole gale from se., and increasing to hurricane force. The wind shifted to sw. with heavy rain, then to w., falling calm, and then coming out from n. and nne. During the 20th the disturbance apparently passed northeastward, and probably united with the low area traced as number 10, which, on the 21st, was moving over Newfoundland. At noon of the 20th the s. s. "Roman," D. Williams, commanding, in N. 45° 57', W. 48° 50', had barometer 29.88 (758.9), wind sw. by w., force 4.

10.—This was a continuation of the low area described as number vii under "Areas of low pressure" in this REVIEW. During the 19th and 20th it passed northeastward over the Maritime Provinces and the Gulf of Saint Lawrence as a severe storm, with pressure at the centre about 29.2 (741.7), and attended by moderate to strong gales from sw. to nw. at sea and along the coast of the United States. On the 21st it was apparently central over Newfoundland, whence it passed northeastward, causing moderate to strong gales from s. to sw. over the ocean near the fiftieth parallel, with barometer ranging from 29.5 (749.3) to 29.7 (754.4). On the 22d the reports indicated the presence of a depression to the southeastward of Nova Scotia, and strong gales from s. to nw. were reported, but at the present writing the reports are insufficient to determine its course.

During the passage of the low area described as number ix under "Areas of low pressure" in this REVIEW, very strong gales prevailed over the western part of the ocean from the 25th to the 30th, the n. and nw. gales over the ocean between the coast of the United States and Bermuda being especially severe, and extending as far south as the West Indies.

#### OCEAN ICE.

The positions of the icebergs reported during December, 1885, are shown on chart i by shaded spots. They were observed by the following vessels:

December 18th.—S. S. "Devonia," in N. 47° 25', W. 46° 0', passed a large iceberg.

19th.—S. S. "Lake Huron," in N. 47° 15', W. 45° 40', passed a large iceberg.

24th.—S. S. "Circassia," in N. 47° 45', W. 45° 33', passed an iceberg.

30th.—S. S. "Carthaginian" observed two icebergs off the entrance to Saint John's Harbor, Newfoundland. The s. s. "Portia" also passed several icebergs on the Newfoundland coast.

For December of the three preceding years no icebergs have been reported by observers of this office.

#### SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to ship-masters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during December, 1885, twelve reports concerning storms encountered by vessels in the Atlantic west of the forty-fifth meridian; one message was sent from Boston.

#### TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

The distribution of mean temperature over the United States and Canada for December, 1885, is exhibited on chart ii by the dotted isothermal lines; and in the tables of miscella-

neous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service.

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

*Average temperatures for December.*

Districts.	Average for Dec. Signal-Service observations.		Comparison of Dec. 1885, with the average for several years.
	For several years.	For 1885.	
New England .....	30.0	31.7	+ 1.7
Middle Atlantic States.....	35.5	38.0	+ 2.5
South Atlantic States.....	48.0	47.1	- 0.9
Florida Peninsula.....	62.5	56.6	- 5.9
Eastern Gulf States.....	50.3	47.4	- 2.9
Western Gulf States.....	50.7	50.7	0.0
Rio Grande Valley.....	50.8	62.2	+ 11.4
Tennessee.....	41.5	40.8	- 0.7
Ohio Valley.....	35.1	35.9	+ 0.8
Lower Lake region.....	30.2	30.7	+ 0.5
Upper Lake region.....	24.1	25.6	+ 1.5
Extreme Northwest.....	10.4	18.6	+ 8.2
Upper Mississippi Valley.....	27.8	29.8	+ 2.0
Missouri Valley.....	23.3	28.0	+ 4.7
Northern slope.....	21.5	33.6	+ 12.1
Middle slope.....	29.3	35.8	+ 6.5
Southern slope.....	41.5	46.0	+ 4.5
Southern plateau.....	43.0	45.8	+ 2.8
Middle plateau.....	32.0	35.4	+ 3.4
Northern plateau.....	30.2	30.6	+ 0.4
North Pacific coast region.....	40.6	43.6	+ 3.0
Middle Pacific coast region.....	48.3	50.6	+ 2.3
South Pacific coast region.....	55.2	57.7	+ 2.5

In the South Atlantic and east Gulf states, Louisiana, and Florida, the mean temperature has been below the December normal, the departures not exceeding 3°, except in Florida, where they ranged from 4° to 8°. The temperature has also averaged slightly below the normal over an area embracing portions of Ohio, Indiana, and southern Michigan, where the departures varied from 0° 5, at Toledo, Ohio, and Indianapolis, Indiana, to 1° 6, at Cincinnati, Ohio. Outside the areas above-mentioned the only Signal Service stations showing mean temperatures below the normal are: Davenport, Iowa, 1° 8; Erie, Pennsylvania, 1° 2; Oswego, New York, 0° 9; Dubuque, Iowa, 0° 4. The month has been warmer than the average in all parts of the country, with the exception of the districts above mentioned. In New England and the middle Atlantic states the departures have averaged 1° 5 and 1° 7, respectively; in the lower lake region, Ohio Valley, and Tennessee they averaged less than 1°; while in all districts to the west of the Mississippi River, except in the west Gulf states, the temperature has been decidedly above the normal, the departures being most marked in the extreme northwest and northern Rocky Mountain districts.

The following are some of the most marked departures from the normal:

Above normal.	Below normal.
Fort Assinaboine, Montana..... 16.1	Sanford, Florida..... 8.4
Fort Buford, Dakota..... 15.8	Cedar Keys, Florida..... 6.9
Fort Benton, Montana..... 15.7	Key West, Florida..... 5.7
Fort Shaw, Montana..... 14.6	Pensacola, Florida..... 5.7
Fort Maginnis, Montana..... 13.6	Augusta, Georgia..... 3.9
Deadwood, Dakota..... 11.8	Jacksonville, Florida..... 3.7
Helena, Montana..... 10.7	Atlanta, Georgia..... 2.6
Bismarck, Dakota..... 9.9	Mobile, Alabama..... 2.6
Lewiston, Idaho..... 8.5	Montgomery, Alabama..... 2.6

#### RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily ranges of temperature, are given in the tables of miscellaneous meteorological data.

The monthly ranges were greatest over the eastern Rocky Mountain slope, where they generally varied from 60° to 80°. The monthly ranges were least in Florida and in the Pacific coast, where they were below 40°.

The following are some of the greatest and least monthly ranges:

Greatest.	Least.
Fort Laramie, Wyoming..... 83.7	Fort Canby, Washington Territory..... 33.6
West Las Animas, Colorado..... 82.2	San Francisco, California..... 23.0
Denver, Colorado..... 79.7	Cape Mendocino, California..... 23.6
Fort Elliott, Texas..... 77.8	Astoria, Oregon..... 30.0
Valentine, Nebraska..... 77.3	Sacramento, California..... 27.0
Poplar River, Montana..... 76.1	Roseburg, Oregon..... 26.5
Cheyenne, Wyoming..... 76.0	Portland, Oregon..... 32.2
North Platte, Nebraska..... 75.0	Key West, Florida..... 32.8

#### DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for December for a series of years, the mean temperature for December, 1885, and the departures from the normal:

Station.	County.	Normal temperature for December.	Number of years.	Mean temperature for Dec., 1885.	Departure.
<b>Arkansas.</b>		0		0	0
Lead Hill.....	Boone.....	37.6	4	39.0	+ 1.4
<b>California.</b>					
Sacramento.....	Sacramento.....	46.3	20	50.0	+ 3.7
<b>Connecticut.</b>					
Middletown.....	Middlesex.....	28.4	27	32.2	+ 3.8
New Haven.....	New Haven.....	30.7	29	33.3	+ 2.6
New London.....	New London.....	32.2	15	35.0	+ 2.8
<b>Dakota.</b>					
Webster.....	Day.....	33.5	3	38.9	+ 0.38
<b>Illinois.</b>					
Peoria.....	Peoria.....	28.7	30	31.2	+ 2.5
Mattoon.....	Coles.....	30.1	5	33.0	+ 2.9
Anna.....	Union.....	45.3	10	41.2	- 4.1
Riley.....	McHenry.....	21.8	24	23.2	+ 1.4
Sycamore.....	De Kalb.....	26.4	4	23.9	- 2.5
<b>Indiana.</b>					
Spiceland.....	Henry.....	29.3	32	30.8	+ 1.5
Vevay.....	Switzerland.....	34.6	21	36.9	+ 2.3
Lafayette.....	Tippecanoe.....	27.3	6	28.7	+ 1.4
<b>Iowa.</b>					
Monticello.....	Jones.....	21.5	30	22.6	+ 1.01
Cresco.....	Howard.....	16.8	10	20.2	+ 3.4
<b>Kansas.</b>					
Lawrence.....	Douglas.....	29.5	18	32.5	+ 3.1
Wellington.....	Sumner.....	30.8	7	34.9	+ 4.2
Independence.....	Montgomery.....	32.2	14	36.4	+ 4.2
Yates Centre.....	Woodson.....	28.9	6	32.4	+ 3.5
<b>Maine.</b>					
Gardiner.....	Kennebec.....	22.4	50	25.9	+ 3.5
Belfast.....	Waldo.....	23.2	26	25.2	+ 2.0
Bridgeton.....	Cumberland.....	22.9	11	22.3	- 0.6
Orono.....	Penobscot.....	20.9	17	25.0	+ 4.1
<b>Maryland.</b>					
Fallston.....	Harford.....	33.3	15	34.8	+ 1.6
Cumberland.....	Alleghany.....	33.6	14	35.0	+ 1.4
<b>Massachusetts.</b>					
Somerset.....	Bristol.....	28.3	15	33.0	+ 4.8
Amherst.....	Hampshire.....	26.7	48	30.6	+ 3.9
Cambridge.....	Middlesex.....	29.1	93	31.0	+ 1.9
Fitchburg.....	Worcester.....	25.8	29	28.2	+ 2.4
Lowell.....	Middlesex.....	28.5	10	29.8	+ 1.3
New Bedford.....	Bristol.....	31.9	74	32.9	+ 1.0
Springfield.....	Hampden.....	28.0	18	31.5	+ 3.5
<b>New Brunswick.</b>					
Saint John.....	Saint John.....	22.5	25	25.4	+ 2.9
<b>New Hampshire.</b>					
Concord.....	Merrimac.....	26.2	18	28.2	+ 2.0
Hanover.....	Grafton.....	20.8	23	21.7	+ 0.9
<b>New York.</b>					
Palermo.....	Oswego.....	24.4	32	25.6	+ 1.2
<b>Ohio.</b>					
Wauseon.....	Fulton.....	26.6	15	28.3	+ 1.7
<b>Pennsylvania.</b>					
Dyberry.....	Wayne.....	25.1	21	27.7	+ 2.6
Wellsborough.....	Tioga.....	28.7	10	31.3	+ 2.6
<b>Rhode Island.</b>					
Providence.....	Providence.....	29.5	51	31.3	+ 1.8
<b>Texas.</b>					
New Ulm.....	Austin.....	54.0	14	54.4	+ 0.4
<b>Vermont.</b>					
Lunenburg.....	Essex.....	20.9	37	23.0	+ 2.1
<b>Virginia.</b>					
Bird's Nest.....	Northampton.....	41.6	16	42.6	+ 1.0
Variety Mills.....	Nelson.....	36.9	9	37.6	+ 0.7
Wytheville.....	Wythe.....	36.1	21	36.1	0.0
Dale Enterprise.....	Rockingham.....	38.2	5	39.5	+ 1.3
<b>West Virginia.</b>					
Helvetia.....	Randolph.....	33.6	10	34.4	+ 0.8

\* From the "Bulletin of the New England Meteorological Society."

The following notes on the temperature for December, and the year 1885, are given by voluntary observers:

**California.**—Sacramento: the annual temperature for 1885, 60° 4, is 0° 2 above the average for twenty years; the maxi



imum temperature for 1885 was 102° 0, and the minimum 31° 0; the extremes during a period of twenty years being 108°, on June 11, 1877, and 16°, on December 27, 1878.

**Illinois.**—Riley, McHenry county: the mean temperature for 1885 was 41° 8, or 3° 2 below the average for the past twenty-two years; the highest temperature during the year was 91° 7, on July 19th, and the lowest, —26° 4, on January 22d.

**Indiana.**—Vevay, Switzerland county: the maximum temperature for 1885 was 62° 0, and the minimum 7° 0; the extremes for December for a period of twenty-one years being 76° 0, in 1865, and —11°, in 1880.

**Iowa.**—Monticello, Jones county: the maximum temperature that has occurred in December since 1854 was 64°, in 1877, and the minimum, —36°, in 1872.

**Kansas.**—Independence, Montgomery county: the mean temperature for 1885, 53° 3, is 3° 2 below the average for thirteen years.

**Maine.**—Gardiner, Kennebec county: the mean temperature for the year 1885, 43° 78, is 0° 09 below the mean for forty-nine years; the coldest day during the year was January 30th, —15° 0, and the warmest, July 9th and 25th, 83° 0; the warmest December occurred in 1881, the mean being 31° 6, and the coldest in 1859, the mean being 13° 9.

**Maryland.**—Fallston, Harford county: the mean temperature for December, 34° 79, is 1° 62 below the average for fifteen years, the extremes during that period being 40° 25, in December, 1877, and 26° 25, in December, 1880.

**Cumberland, Alleghany county:** the mean temperature for December, 1885, 35° 0, is 1° 4 above the average for the past fourteen years; the highest mean, 40° 0, occurred in 1877, and the lowest, 28° 0, in 1872, the extremes during this period being 66° 0, in 1873, and —2° 0, in 1872.

**Massachusetts.**—Somerset, Bristol county: the mean temperature for 1885, 49° 04, is 0° 37 below the average for fifteen years.

**Westborough, Worcester county:** the mean temperature for 1885, 48° 0, is 0° 2 above the normal for five years.

**New Hampshire.**—Contoocook, Merrimac county: mean temperature for December, 1885, is 27° 4, or about 4° above the normal.

**New York.**—Palermo, Oswego county: the mean temperature for 1885 was 40° 80, or 1° 50 below the normal for the past thirty-two years.

**North Volney, Oswego county:** the mean temperature for December, 27° 69, is 2° 01 above the average for the past eighteen years; the highest December mean being 33° 73, in 1881, and the lowest, 18° 02, in 1876; the mean temperature for the year, 42° 62, is 2° 49 below the average for seventeen years, the highest mean being 47° 74, in 1878, and the lowest, 41° 61, in 1875.

**Ohio.**—Wauseon, Fulton county: the highest December mean for a period of fifteen years was 38° 8, in 1877, and the lowest, 17° 1, in 1872, the December extremes for the same period being 70° 0, in 1875, and —32° 4, in 1884; the mean temperature for 1885, 44° 6, is 3° 3 below the average for the past fifteen years, and, with the exception of 1875 (44° 2), is the lowest annual mean during that period, the highest being 50° 3, in 1878.

**Texas.**—New Ulm, Austin county: the highest mean temperature for December for a period of fourteen years was 60° 89, in 1875, and the lowest, 46° 09, in 1876; the extremes during this period were, maximum, 86° 0, in 1875, and minimum, 9° 0, in 1880.

**Virginia.**—Variety Mills, Nelson county: the highest December mean for a period of nine years was 43° 3, in 1879, and the lowest, 30° 6, in 1876.

**West Virginia.**—Helvetia, Randolph county: December was the first month during 1885 in which the mean was above the average; the mean temperature for the year, 48° 0, is 2° 3 below the average for the past ten years.

Mr. J. S. A. Farrow, of Parkersburg, Wood county, West

Virginia, furnishes the following summary, covering a period of six years, with the accompanying note:

Years.	Temperature.					Precipitation.
	Mean.	Max.	Date.	Min.	Date.	Range.
1880.....	57.25	99	July 13	—8	Dec. 30.....	107
1881.....	56.37	102	July 10	—11	Jan. 1.....	113
1882.....	55.51	93	June 25	—1	Dec. 8.....	94
1883.....	54.60	95	Aug. 27	9	Jan. 15, 24, 25.....	86
1884.....	55.86	96	Aug. 20	—11	Jan. 5.....	85
1885.....	53.07	95	July 21	—11	Feb. 21.....	106

The mean temperature for 1885, 53° 07, is 2° 37 below the average for the past five years; the warmest days were July 17th, 20th, 21st, the mean being 85° 50, and the coldest days were January 22d and 28th, the mean being 5° 25. The total precipitation for 1885, 34.54 inches, is 6.21 inches below the average; of this amount, 13.21 inches, or 38.2 per cent., fell during the months of January and August, the smallest monthly rainfall being 0.80 inch, in March.

Dr. C. T. Stucky, voluntary observer at Helvetia, Randolph county, West Virginia, furnishes the following temperature record for a period of ten years:

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean.
1876.....	39.7	30.3	37.5	49.3	61.0	69.7	73.2	71.8	61.0	48.4	42.0	24.8	51.2
1877.....	30.9	37.6	37.2	47.8	53.4	67.1	70.7	66.7	59.7	50.6	40.8	40.0	53.3
1878.....	29.0	35.8	45.0	53.4	55.8	62.1	72.3	66.6	59.6	48.6	39.6	26.4	49.6
1879.....	28.5	27.7	40.6	46.0	59.2	63.9	71.4	66.2	56.9	54.7	40.6	42.5	49.8
1880.....	43.1	35.8	39.5	50.4	62.3	66.4	67.5	68.0	62.9	48.9	34.4	24.6	50.3
1881.....	28.5	31.2	36.3	44.3	59.3	65.5	69.2	66.8	67.9	56.8	43.5	39.2	50.7
1882.....	35.0	40.6	44.7	50.0	57.0	65.5	66.9	66.9	61.7	56.1	40.4	31.6	51.4
1883.....	33.7	38.2	35.9	50.3	54.5	68.6	70.0	66.5	61.8	56.5	45.0	36.4	51.8
1884.....	26.1	40.6	41.5	46.4	57.8	67.5	66.6	66.1	63.3	54.0	40.1	35.8	50.5
1885.....	30.7	25.7	32.6	47.3	50.4	65.7	69.5	67.2	59.9	47.5	39.6	34.4	49.0
Average.....	32.6	34.9	39.1	48.2	58.1	66.2	69.7	67.5	61.5	52.2	40.6	33.6	50.3

From the above table it will be seen that 1885 was the coldest year that has occurred in the past ten years, the mean temperature, 48° 0, being 2° 3 below the normal.

Mr. Howard Shriver, voluntary observer at Wytheville, Wythe county, Virginia, furnishes a temperature record covering a period of twenty-one years, of which the following is a summary:

Month.	Normal temperature (at years' observations).	Highest mean.	Year of highest mean.	Lowest mean.	Year of lowest mean.	Highest and lowest observed in 21 years.			
						Maximum.	Year.	Minimum.	Year.
January.....	0	0	1861	29	1884	73	1880	—6	1872, 1879
February.....	35	57	1864	30	1885	74	1874, 1883	—8	1872, 1879
March.....	43	49	1878	37	1870, 1872, 1881, 1885	79	1869	—1	1869
April.....	53	56	1866	47	1881	83	1868, 1878	17	1881
May.....	61	66	1880	50	1866	90	74, 77, 81	32	78, 79, 83
June.....	68	73	1874	64	1866, 1878	92	1871	42	1880
July.....	72	75	1862	67	1861	96	1866, 1861	43	1885
August.....	71	74	1862, 1869	63	1864	94	1861	40	1865
September.....	63	70	1881	60	1879	92	1881	32	1879
October.....	54	59	1879	47	1859	87	1883	21	1873
November.....	42	45	81, 83, 85	36	1869	83	1879	2	1873
December.....	35	42	1879	26	1876	73	1877	—10	1868, 1880

The mean temperature for 1885 was 52° 7, which is about the average for the past twenty-one years, the normal as shown by the record being 53°; the highest yearly mean was 55°, in 1862, and the lowest, 52°, in 1875 and 1876; the coldest month is December, averaging 35°, and the warmest month is July, averaging 73°; the coldest days for the entire period occurred in December, 1868 and 1880, when the thermometer recorded —10°; the warmest days during the same period occurred in July, 1866 and 1881, the thermometer in each case recording 96°.

#### FROSTS.

Frosts occurred in the various districts on the following dates:

**New England.**—1st to 31st.

**Middle Atlantic states.**—1st to 31st.

**South Atlantic states.**—1st to 30th.

Table of comparative maximum and minimum temperatures for December.

State or Territory.	Station.	For 1885.		Since establishment of station.			
		Max.	Min.	Max.	Year.	Min.	Year.
Alabama	Mohile	69.4	26.0	78.8	1884	14.0	1880
Do	Montgomery	70.0	25.0	77.1	1884	8.0	1880
Arizona	Prescott	65.5	10.0	68.2	1882	-18.0	1879
Do	Yuma	78.1	39.6	80.0	1878	27.0	1879
Arkansas	Fort Smith	75.2	9.8	78.1	1883	9.5	1882
Do	Little Rock	71.2	19.3	74.4	1880	6.0	1880
California	San Francisco	67.0	44.0	68.0	1878	34.0	1879
Do	San Diego	74.1	5.6	82.0	1874	32.2	1879
Colorado	Denver	74.1	19.6	71.0	1874	-25.0	1876
Do	Pike's Peak	26.4	-19.6	30.0	1871	-37.0	1878
Connecticut	New Haven	59.4	10.3	62.0	1875	-9.5	1884
Do	New London	59.3	10.3	60.5	1879	-7.5	1881
Dakota	Fort Buford	59.3	-10.3	56.8	1884	-40.0	1879
Do	Yankton	58.8	-10.1	62.0	1875	-34.0	1879
Delaware	Del. Breakwater	58.8	-10.1	69.0	1881	1.0	1880
Do	Cape Henlopen	62.1	17.0	73.0	1873	-13.0	1880
District of Columbia	Washington City	63.9	13.9	73.0	1873	-13.0	1880
Florida	Jacksonville	70.0	32.2	81.0	1875	19.0	1880
Do	Key West	83.0	32.2	88.0	1876	44.0	1876
Georgia	Augusta	71.9	23.0	77.0	1874, 1875	7.0	1880
Do	Savannah	71.8	30.0	80.0	1875	15.0	1880
Idaho	Boise City	60.5	6.4	59.0	1879	-7.3	1884
Do	Lewiston	59.0	16.0	54.0	1880, 1883	-10.0	1879, 1884
Illinois	Cairo	62.7	14.4	72.0	1875	-7.0	1872
Do	Chicago	50.3	2.9	67.0	1877	-15.0	1880
Indiana	Indianapolis	56.3	2.1	68.0	1875	-15.0	1876
Do	Greencastle	54.3	2.1	68.0	1875	-15.0	1876
Indian Territory	Fort Sill	70.5	15.3	75.0	1879	2.0	1879, 1880
Iowa	Des Moines	55.9	3.0	57.0	1883	-18.2	1884
Do	Keokuk	53.4	3.0	68.0	1875	-32.0	1872
Do	Dodge City	70.0	5.3	73.0	1875	-15.0	1876
Kansas	Leavenworth	57.2	1.5	72.0	1875	-14.0	1880
Do	Louisville	66.9	9.4	74.0	1875	-7.0	1880
Louisiana	New Orleans	73.5	30.4	78.0	1871, 1875, 1879, 1880	20.0	1880
Do	Shreveport	73.2	25.4	79.0	1875	10.0	1880
Maine	Eastport	52.9	7.4	54.0	1877	-20.0	1875
Do	Portland	55.3	6.0	56.0	1875	-17.0	1872
Maryland	Baltimore	64.4	14.7	71.0	1881	3.0	1880
Massachusetts	Boston	61.5	11.8	66.0	1881	-12.0	1883
Michigan	Alpena	46.2	-4.7	52.0	1883	-15.0	1880
Do	Detroit	54.8	0.7	65.0	1876	-24.0	1872
Minnesota	Saint Paul	51.6	-17.9	56.0	1877	-39.0	1879
Do	Saint Vincent	39.4	-30.7	44.8	1884	-47.8	1884
Mississippi	Vicksburg	73.0	22.5	79.0	1873, 1875	12.0	1880
Do	Saint Louis	64.9	6.0	74.0	1875	-17.0	1872
Missouri	Fort Benton	73.3	9.9	71.0	1885	-31.0	1876
Montana	Helena	56.8	3.2	52.0	1883, 1884	-40.0	1880
Nebraska	Omaha	60.0	-4.4	66.0	1875	-17.0	1879, 1884
Do	North Platte	69.0	-6.0	67.0	1878	-26.0	1880
Nevada	Winnemucca	54.2	16.0	65.0	1878	-20.0	1879
New Hampshire	Mount Washington	41.8	-16.1	43.0	1884	-47.0	1876
New Jersey	Atlantic City	53.3	12.5	63.5	1875	-7.0	1880
Do	Sandy Hook	60.1	16.1	61.3	1884	5.0	1880
New Mexico	Santa Fé	57.0	-1.0	65.0	1878	-13.0	1879
New York	Buffalo	61.5	5.3	60.0	1873	-9.0	1880
Do	New York City	60.1	14.1	66.2	1881	-6.0	1880
North Carolina	Charlotte	66.2	20.1	71.0	1884	5.0	1880
Do	Wilmington	61.4	2.7	68.0	1879	10.0	1880
Ohio	Cleveland	61.4	2.7	68.0	1875	-12.0	1872
Do	Cincinnati	60.0	3.3	72.0	1875	-8.0	1872
Oregon	Portland	59.2	27.0	63.0	1875, 1880	3.0	1879
Do	Roseburg	61.0	32.5	65.0	1880	7.0	1879
Pennsylvania	Philadelphia	60.1	14.8	70.0	1873	-5.0	1880
Do	Pittsburg	72.8	6.2	69.0	73.75, 80	-9.0	1880
Rhode Island	Block Island	57.4	17.4	60.0	1884	-1.0	1883
Do	Newport	70.0	28.0	76.0	1881	3.0	1875
South Carolina	Charleston	68.2	19.3	73.0	1874	5.0	1880
Tennessee	Knoxville	68.2	19.3	73.0	1874	5.0	1880
Do	Nashville	68.2	19.3	73.0	1874	5.0	1880
Texas	Galveston	72.5	34.3	74.8	79, 81, 83	18.0	1880
Do	El Paso	72.4	12.5	74.8	1881	5.0	1880
Utah	Salt Lake City	57.3	4.6	61.0	1874	-10.0	1879
Vermont	Barre	56.3	11.0	63.0	1877	-21.6	1884
Virginia	Lynchburg	65.5	15.7	73.0	1873	-5.0	1880
Do	Norfolk	68.8	22.3	73.0	1873, 1874, 1875, 1879	0.0	1880
Washington Ter.	Dayton	64.2	22.7	72.0	1880	-26.0	1884
Do	Olympia	64.2	22.7	72.0	1880	-26.0	1884
West Virginia	Morgantown	53.0	-9.5	60.0	1877	-37.0	1872
Wisconsin	La Crosse	47.1	-11.0	63.0	1877	-21.6	1884
Do	Milwaukee	47.1	-11.0	63.0	1877	-21.6	1884
Wyoming	Cheyenne	64.2	-11.8	64.0	1877	-24.0	1879, 1880

Florida Peninsula.—3d, 4th, 6th, 7th, 15th to 18th, 20th, 27th, 28th, 29th.

East Gulf states.—2d, 3d, 5th to 8th, 10th, 11th, 12th, 14th to 19th, 21st, 26th to 29th.

West Gulf states.—1st, 2d, 3d, 5th to 21st, 24th to 31st.

Rio Grande Valley.—14th, 15th.

Tennessee.—3d, 4th, 6th, 10th, 11th, 12th, 14th to 17th, 19th to 23d, 25th to 28th, 31st.

Ohio Valley.—1st to 22d, 24th to 28th, 30th, 31st.

Lower lake region.—1st to 30th.

Upper lake region.—1st to 31st.

Extreme northwest.—1st to 31st.

Upper Mississippi Valley.—1st to 31st.

Missouri Valley.—1st to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 31st.

Southern slope.—1st, 2d, 5th, 6th, 7th, 9th, 10th, 12th to 18th, 30th, 31st.

Southern plateau.—1st to 17th, 20th, 21st, 23d, 24th, 25th, 27th, 29th, 30th, 31st.

Middle plateau.—1st to 6th, 8th to 31st.

Northern plateau.—2d to 15th, 19th, 20th, 21st, 27th, 28th, 29th, 31st.

North Pacific coast region.—3d to 8th, 10th to 14th, 18th, 19th, 20th, 22d, 26th to 31st.

Middle Pacific coast region.—7th, 8th, 9th, 11th, 12th, 13th, 18th, 19th, 20th, 27th to 31st.

South Pacific coast region.—4th, 6th, 8th to 11th, 13th to 17th, 28th, 29th, 30th.

#### ICE.

Ice formed in the southern parts of the country, as follows:

Alabama.—Greensborough, 1st, 11th, 14th, 27th, 28th.

Arkansas.—Little Rock, 7th, 11th, 15th; Lead Hill, 6th, 7th, 9th, 10th to 19th, 25th, 26th, 27th.

Arizona.—Yuma, 10th, 14th, 15th.

Florida.—Archer, 6th, 7th, 15th, 16th, 27th, 28th, 29th; Sanford, 6th, 15th, 28th; Pensacola, 11th, 27th; Limona, 6th, 28th; Manatee, 7th, 28th.

Georgia.—Athens, 5th, 6th, 10th, 12th, 15th, 16th, 17th, 20th, 26th, 27th; Atlanta, 6th; Savannah, 6th, 15th.

Louisiana.—Point Pleasant, 5th, 6th, 10th, 11th, 14th, 15th, 16th, 28th; New Orleans, 15th, 16th; Shreveport, 10th, 11th, 14th, 15th.

North Carolina.—Raleigh, 6th; Smithville, 6th, 15th, 26th, 27th.

Tennessee.—Knoxville, 4th.

Texas.—Palestine, 6th; Indianola, 14th.

Virginia.—Lynchburg, 7th; Chincoteague, 6th.

#### PRECIPITATION.

[Expressed in inches and hundredths.]

The distribution of rainfall over the United States and Canada for December, 1885, as determined from reports from more than seven hundred stations, is exhibited on chart iii.

In the following table are shown, for the several geographical districts, the normal December precipitation for a series of years; the average for December, 1885, and the excess or deficiency as compared with the normal:

Average precipitation for December.

Districts.	Average for December, Signal-Service observations.		Comparison of Dec., 1885, with the average for several years.
	For several years.	For 1885.	
	Inches.	Inches.	Inches.
New England	3.67	3.24	-0.43
Middle Atlantic States	3.59	3.18	-0.41
South Atlantic States	4.26	5.01	+0.75
Florida Peninsula	2.34	3.79	+1.45
Eastern Gulf States	5.49	3.73	-1.76
Western Gulf States	4.35	2.75	-1.60
Rio Grande Valley	1.80	0.80	-1.00
Tennessee	4.60	3.42	-1.18
Ohio Valley	3.76	2.27	-1.49
Lower lake region	3.06	2.81	-0.25
Upper lake region	2.42	2.51	+0.09
Extreme northwest	0.93	0.47	-0.46
Upper Mississippi Valley	2.16	2.13	-0.03
Missouri Valley	0.87	0.49	-0.38
Northern slope	0.94	0.60	-0.34
Middle slope	1.03	1.48	+0.45
Southern slope	1.30	0.91	-0.39
Southern plateau	1.56	0.90	-0.66
Middle plateau	1.38	0.96	-0.42
Northern plateau	2.64	1.64	-1.00
North Pacific coast region	8.05	6.47	-1.58
Middle Pacific coast region	4.78	4.87	+0.09
South Pacific coast region	2.20	0.83	-1.37

In northeastern New England, along the immediate coast of the Atlantic from New Jersey southward, over a narrow area



extending from the middle Rocky Mountain slope northeastward to the Lake region, in northeastern Montana, and on the middle Pacific coast, the rainfall for December was in excess of the average. The departures in the districts named were generally small, except on the south Atlantic coast, where the excess amounted to more than two inches. In all other districts the rainfall was below the average, the deficiency being quite marked over an area extending from the west Gulf states to the upper Ohio valley; over the greater part of this area the departures below the normal amounted to, or exceeded, two inches. Marked deficiencies also occurred on the north and south Pacific coasts.

#### DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of December for a series of years; the precipitation for December, 1885; and the departures from the average:

Station.	County.	Average precipitation for Dec.	Number of years.	Precipitation for December, 1885.	Departure.
		Inches.		Inches.	Inches.
<i>Arkansas.</i>					
Lead Hill.....	Boone.....	5.41	4	2.30	- 3.11
<i>California.</i>					
Sacramento.....	Sacramento.....	3.66	20	5.33	+ 1.67
<i>Connecticut.</i>					
Hartford.....	Hartford.....	3.51	13	3.89	+ 0.38
Middletown *.....	Middlesex.....	3.67	27	3.54	- 0.13
New Haven *.....	New Haven.....	3.63	13	3.31	- 0.32
New London *.....	New London.....	3.47	15	3.92	+ 0.45
Wallingford *.....	New Haven.....	4.08	27	4.25	+ 0.17
<i>Dakota.</i>					
Webster.....	Day.....	2.13	3	0.63	- 1.50
<i>Illinois.</i>					
Peoria.....	Peoria.....	2.48	.....	2.44	- 0.04
Mattoon.....	Coles.....	3.26	5	3.00	- 0.26
Anna.....	Union.....	3.99	10	2.93	- 1.06
Riley.....	McHenry.....	1.98	25	2.37	+ 0.39
Sycamore.....	De Kalb.....	3.00	4	3.05	+ 0.05
<i>Indiana.</i>					
Spiceland.....	Henry.....	2.93	26	2.36	- 0.57
Vevay.....	Switzerland.....	4.23	21	2.02	- 2.21
Lafayette.....	Tiptecano.....	3.19	6	2.54	- 0.65
<i>Iowa.</i>					
Monticello.....	Jones.....	2.40	30	2.48	+ 0.08
Cresco.....	Howard.....	1.49	10	1.49	0.00
<i>Kansas.</i>					
Lawrence.....	Douglas.....	1.66	18	1.25	- 0.41
Wellington.....	Sumner.....	1.33	7	1.57	+ 0.24
Independence.....	Montgomery.....	2.29	13	0.95	- 1.34
Yates Centre.....	Woodson.....	1.51	6	1.08	- 0.43
<i>Maine.</i>					
Gardiner.....	Kennebec.....	3.68	48	2.60	- 1.08
<i>Maryland.</i>					
Fallston.....	Harford.....	3.58	15	2.64	- 0.94
Cumberland.....	Alleghany.....	2.25	14	1.55	- 0.70
<i>Massachusetts.</i>					
Somerset.....	Bristol.....	3.24	15	2.60	- 0.64
Amherst *.....	Hampshire.....	3.56	51	3.99	+ 0.34
Cambridge *.....	Middlesex.....	3.68	45	1.91	- 1.77
Fitchburg *.....	Worcester.....	2.28	21	2.39	+ 0.11
Lake Cochituate *.....	Bristol.....	3.44	34	2.32	- 1.12
Lowell *.....	Middlesex.....	3.25	61	3.10	- 0.15
New Bedford *.....	Bristol.....	3.91	73	3.04	- 0.87
Springfield *.....	Hampden.....	3.50	38	4.39	+ 0.89
Waltham *.....	Middlesex.....	2.90	60	2.22	- 0.68
Worcester *.....	Worcester.....	3.58	45	3.09	- 0.49
Williamstown *.....	Berkshire.....	2.55	18	3.43	+ 0.88
<i>New Brunswick.</i>					
Saint John *.....	Saint John.....	4.55	25	7.76	+ 3.21
<i>New Hampshire.</i>					
Antrim.....	Hillsborough.....	3.73	14	4.35	+ 0.62
Concord *.....	Merrimac.....	2.84	30	3.00	+ 0.16
Hanover *.....	Grafton.....	2.08	19	2.21	+ 0.13
<i>New York.</i>					
Palermo.....	Oswego.....	4.10	32	3.93	- 0.17
<i>Ohio.</i>					
Wauseon.....	Fulton.....	2.31	13	2.57	+ 0.26
<i>Pennsylvania.</i>					
Dyberry.....	Wayne.....	2.55	17	2.23	- 0.32
<i>Rhode Island.</i>					
Providence *.....	Providence.....	3.90	54	2.71	- 1.19
<i>Texas.</i>					
New Ulm.....	Austin.....	4.87	14	3.79	- 1.08
<i>Vermont.</i>					
Lunenburg.....	Essex.....	2.94	38	1.70	- 1.24
<i>Virginia.</i>					
Bird's Nest.....	Northampton.....	3.70	16	3.15	+ 0.55
Variety Mills.....	Nelson.....	3.90	7	2.85	- 1.05
Wytheville.....	Wythe.....	2.92	21	3.02	+ 0.10
Dale Enterprise.....	Rockingham.....	1.89	5	2.53	+ 0.64
<i>West Virginia.</i>					
Helvetia.....	Randolph.....	4.70	9	3.19	- 1.51

\* From the "Bulletin of the New England Meteorological Society."

The following notes are given by voluntary observers:

*Illinois.*—Riley, McHenry county: the total precipitation

for 1885 was 36.39, or 2.31 above the average for the past twenty-four years; from December 4th to 13th 15.25 of snow fell, being the greatest ever recorded at this place in the first half of December, and probably the heaviest fall since 1846.

*Indiana.*—Vevay, Switzerland county: the greatest precipitation for any December during a period of twenty-one years was 7.60, in 1879, and the least, 1.20, in 1876.

*Iowa.*—Monticello, Jones county: the greatest precipitation that has occurred in any December for a period of thirty years was 6.99, in 1856, and the least, 0.65, in 1867.

*Kansas.*—Wellington, Sumner county: the total precipitation for 1885 was 35.28, or 2.55 above the average for seven years.

Independence, Montgomery county: the total precipitation for 1885 was 44.30, being 5.90 above the average for thirteen years.

*Maine.*—Gardiner, Kennebec county: the total precipitation for 1885 was 43.95, or 0.34 below the average for forty-seven years.

*Maryland.*—Fallston, Harford county: the annual precipitation for 1885, 50.68, is 4.31 above the average for fourteen years, the greatest precipitation occurring in 1877, 57.10, and the least in 1879, 35.15.

Cumberland, Alleghany county: the annual precipitation for 1885, 27.09, is 3.07 below the average for fourteen years.

*Massachusetts.*—Somerset, Bristol county: the annual precipitation for 1885, 35.73, is 9.33 below the average for the past fifteen years, and is the smallest amount for any year during this period.

Westborough, Worcester county: the total precipitation for 1885, 43.37, is 1.97 above the average for the previous ten years.

*New Hampshire.*—Antrim, Hillsborough county: the annual precipitation for 1885 was 44.75, being exactly the average for the past thirteen years.

*New Jersey.*—Moorestown, Burlington county: the precipitation for 1885 was 38.11, being 4.9 below the average; of this, 10.24 fell during the months of July and August. At the close of the year the supply of water in wells and springs is lower than at any time during the past twenty-two years.

*New York.*—Palermo, Oswego county: the precipitation for 1885 was 33.40, or 6.20 above the average for the past thirty-two years. The yearly snowfall was 97.0, being 6.0 above the average.

North Volney, Oswego county: rain or snow fell during the month on twenty-five days, the total precipitation being 3.65, or 0.26 above the average for fourteen years; rain or snow fell during the year on two hundred and seven days, amounting to 34.55, or 0.06 below the average for eighteen years, the extremes during this period being 48.35, in 1878, and 29.90, in 1882.

*Ohio.*—Wauseon, Fulton county: the largest monthly rainfall that has occurred in any December for the past thirteen years was 4.32, in 1879, and the smallest, 0.41, in 1874; the total precipitation for 1885 was 36.00, or 2.96 below the average, the largest annual rainfall being 49.58, in 1876, and the smallest, 31.07, in 1872; the snowfall for December, 1885, 7.2, is 2.00 less than the average, the extremes for December being 26.1, in 1872, and 8.0, in 1877; the annual snowfall for 1885, 48.5, is nearly 2.00 below the average, the largest yearly snowfall being 78.2, in 1875, and the smallest, 30.2, in 1880.

*Texas.*—New Ulm, Austin county: the greatest precipitation for December for a period of fourteen years was 16.43, in 1875, and the least, 0.44, in 1880.

*Virginia.*—Variety Mills, Nelson county: the greatest December precipitation for a period of seven years was 6.29, in 1881, and the least, 1.80, in 1880.

*West Virginia.*—Helvetia, Randolph county: the total precipitation for 1885, 46.32, is 9.42 below the average for ten years.

The following is a summary of a rainfall record covering a period of twenty-one years, as furnished by Mr. Howard

Shriver, voluntary observer at Wytheville, Wythe county, Virginia:

Month.	Average monthly rainfall for 31 years.	Total monthly rainfall for 1885.	Departure.	Greatest monthly rainfall (21 years).	Year.	Least monthly rainfall (21 years).	Year.
	Inches.	Inches.		Inches.		Inches.	
January .....	3.6	3.8	+0.2	7.1	1882	1.5	1872
February .....	3.4	1.9	-1.5	8.0	1863	0.3	1877
March .....	3.6	1.5	-2.1	8.0	1884	1.5	1879
April .....	3.5	2.2	-1.3	6.5	1863	0.8	1876
May .....	3.6	7.0	+3.4	7.3	1873	0.5	1875
June .....	3.9	1.4	-2.5	9.1	1875	1.4	1885
July .....	3.9	1.3	-2.6	8.1	1861	0.9	1883
August .....	3.7	3.7	0.0	7.6	1876, 1882	1.4	1884
September .....	3.6	1.7	-1.9	8.3	1878	0.3	1862
October .....	3.0	4.7	+1.7	9.4	1860	0.5	1875
November .....	2.6	2.6	0.0	7.1	1877	0.5	1862
December .....	2.9	3.0	+0.1	6.0	1871	0.2	1861

The average annual precipitation for a period of twenty-one years is 41.3, while that for 1885 is 34.8, or 6.5 below the normal; the greatest annual precipitation occurred in 1878, amounting to 52.5, and the least annual precipitation occurred in 1876, when only 33.1 fell; the greatest rainfall on any one day during this period occurred on September 12, 1878, when 7.0 fell, and the greatest rainfall for any one hour during the same period was 3.75, on June 25, 1875.

Rev. J. H. White, voluntary observer at Merritt's Island, Brevard county, Florida, furnishes the following rainfall record:

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	Average.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January .....	10.45	1.38	4.49	4.30	2.74	6.09	0.57	3.85	4.09
February .....	4.37	3.47	3.27	2.43	0.15	0.20	3.26	5.55	2.84
March .....	7.92	1.59	2.79	1.24	0.70	2.30	2.19	4.92	2.06
April .....	9.74	3.23	1.81	3.06	2.89	4.05	1.73	0.53	3.46
May .....	1.47	8.71	5.16	3.45	2.46	2.41	4.53	7.57	4.47
June .....	3.32	6.65	6.85	7.04	9.83	5.38	13.26	9.27	7.73
July .....	5.04	4.25	6.07	5.72	7.21	0.86	11.72	2.71	5.45
August .....	5.70	12.11	15.77	5.42	3.32	1.15	5.79	10.28	7.44
September .....	23.78	10.28	3.61	4.40	3.01	2.88	7.28	11.15	8.30
October .....	0.41	11.30	4.44	2.24	1.67	11.82	1.59	4.61	5.51
November .....	1.02	3.04	1.85	1.73	5.43	3.70	5.67	0.42	2.08
December .....	1.38	3.70	3.12	1.95	2.03	0.46	3.32	1.27	1.85
Total .....	80.60	68.28	59.34	42.99	41.83	41.10	59.93	61.13	

Annual average, 55.90.

The following is an extract from the letter transmitting the above record:

Enclosed I send you a record of rainfall for eight years, to which the correction indicated by the standard rain-gauge has been applied. Since there is no published record of rainfall for this region, is it not of sufficient interest to justify its publication in the MONTHLY REVIEW? This place is quite remote from any other station; its proximity to the Gulf Stream and island location make the situation of unusual climatic interest.

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

Above normal.		Below normal.	
	Inches.		Inches.
Jacksonville, Florida .....	4.78	Mackinaw City, Michigan .....	3.48
Pike's Peak, Colorado .....	2.77	Atlanta, Georgia .....	3.38
Charleston, South Carolina .....	2.68	Vicksburg, Mississippi .....	3.01
Savannah, Georgia .....	2.08	Galveston, Texas .....	2.86
Sacramento, California .....	1.71	Chattanooga, Tennessee .....	2.59
Fort Macon, North Carolina .....	1.60	Fort Smith, Arkansas .....	2.45
Santa Fe, New Mexico .....	1.53	Cincinnati, Ohio .....	2.16

#### SNOW.

The dates on which snow fell in the various districts are as follows:

*New England.*—1st to 11th, 13th, 14th, 15th, 17th to 23d, 26th, 27th, 28th, 31st.

*Middle Atlantic states.*—1st to 8th, 11th to 21st, 25th, 28th.

*South Atlantic states.*—2d to 5th, 12th, 13th, 16th, 18th, 19th, 20th, 25th, 26th, 28th.

*West Gulf states.*—1st, 9th, 12th, 13th, 14th.

*Tennessee.*—4th, 5th, 14th.

*Ohio Valley.*—1st, 3d to 6th, 8th to 15th, 17th, 19th, 20th, 23d, 24th, 25th, 27th to 31st.

*Lower lake region.*—1st to 28th.

*Upper lake region.*—1st to 19th, 21st to 31st.

*Extreme northwest.*—1st, 2d to 16th, 22d to 25th, 29th, 30th, 31st.

*Upper Mississippi Valley.*—1st to 14th, 16th, 30th, 31st.

*Missouri Valley.*—4th to 14th, 16th, 29th, 30th.

*Northern slope.*—3d, 4th, 6th to 13th, 15th, 29th, 30th, 31st.

*Middle slope.*—4th, 6th to 13th, 19th, 20th, 22d, 25th to 31st.

*Southern slope.*—8th.

*Southern plateau.*—7th, 8th, 9th, 11th, 21st, 28th, 29th.

*Middle plateau.*—6th to 11th, 15th, 16th, 19th to 22d, 27th to 31st.

*Northern plateau.*—6th to 10th, 15th, 16th, 21st, 29th, 30th, 31st.

*North Pacific coast region.*—3d, 7th, 8th, 9th, 14th, 15th, 30th, 31st.

#### LARGEST MONTHLY SNOWFALLS.

[Expressed in inches and tenths.]

Monthly snowfalls of five inches or more were reported from the various states and territories during the month, as follows:

*California.*—Summit, 30; Susanville, 10.5.

*Colorado.*—Pike's Peak, 40.1; Braddock, 35.8; Montrose, 9; Denver, 8.3.

*Connecticut.*—North Colebrook, 9.4.

*Dakota.*—Deadwood, 22.1; Yankton, 13.9; Fort Totten, 5.3.

*Illinois.*—Rockford, 20.8; Geneseo, 16.5; Sandwich and Bloomington, 16; Riley, 15.5; Chicago, 14.6; Sycamore, 14; Windsor, 8.6; Springfield, 8.3; Philo, 8; Bunker Hill, 6.4; Charleston, 5.8.

*Indiana.*—Logansport, 15.1; Guilford, 15; Greencastle, 7.9; Mauzy, 7; Fort Wayne, 6.8; Lafayette, 6.1; La Grange, Spiceland, and Dana, 6; Monticello, 5.6; Indianapolis, 5.3; Degonia, 5.

*Iowa.*—Dubuque, 14; Des Moines, 13.2; Guttenberg, 12.2; Keokuk, 11.5; Muscatine, 11; Fort Madison and Cedar Rapids, 10; West Union, 8.4; Cresco and Monticello, 7.5; Oskaloosa a, 7; Oskaloosa b, 6.5; Humboldt, 6; Independence, 5.9.

*Kansas.*—Wellington, 15; Ninnescab, 11; Lawrence, Fort Scott, and Elk Falls, 10; Independence, 9.7; Yates Centre, 7.8; Atchison, 7; West Leavenworth, 6.3; Leavenworth, 6.

*Maine.*—Orono, 28; Belfast, 20; Cornish, 18; Bridgeton, 17.5; Mayfield, 15.2; Kent's Hill a and Gardiner, 14; Solon, 13.2; Buckfield, 13; Petit Manon, 12.5; Eastport, 12.2; Portland, 11.2; Kent's Hill b, 10.5; Bar Harbor, 7.5.

*Massachusetts.*—Newburyport and Williamstown, 12; Northfield, 9; Beverly Farm, 8.6; Westborough, 8; Worcester and Lawrence, 7.8; Fitchburg and Concord, 7.6; Gilbertville, 7.2; Fall River, 6.5; Boston, Springfield, and Westvale, 5.5; Amherst b, Hopkinton, Leominster, and Rowe, 5.

*Michigan.*—Traverse City, 34.5; Alpena, 28.6; Escanaba, 25.2; Manistique, 23; Lansing, 21; Mackinaw City, 19.8; Kalamazoo, 18; Grand Haven, 17.3; Port Huron, 12.5; Pentwater, 12; Marquette, 11.3; Birmingham, 10.6; Detroit, 10.1; Hudson, 8.4; Mottville, 7.

*Minnesota.*—Northfield, 6.7; Minneapolis, 5.5; Saint Vincent, Saint Paul, and Duluth, 5.3.

*Missouri.*—Carthage, 10; Lamar, 7.4; Pierce City, 7.2.

*Montana.*—Poplar River, 11.6; Fort Maginnis, 8.6.

*Nebraska.*—De Soto, 10.8; Crete, 5.9; Minden, 5.

*Nevada.*—Toano and Carlin, 6; Halleck, 5.5; Elko, 5.3.

*New Brunswick.*—Saint John, 21.8.

*New Hampshire.*—Mount Washington, 23.3; Antrim, 17.5; Concord, 15; Littleton, 11.8; Warner, 11; Hanover, 8.5; Manchester b, 8.4; Nashua, 8.2; Walpole, 7.5; Manchester a, 6.

*New York.*—Oswego, 33.8; Buffalo, 25.6; Palermo, 25.2; Humphrey, 22.5; Le Roy, 15.5; Auburn, 9.5; Ithaca, 9.1; Rochester, 8.4; Cooperstown, 7.5.

*Ohio.*—Garrettsville, 10; Hiram, 9; Wauseon, 7.2; Napoleon,



7.1; Ruggles, 7; Tiffin, 6.8; Sandusky and Toledo, 6.6; Cleveland, 5.9.

*Pennsylvania.*—Grampian Hills, 18; Wellsborough, 15.4; Wysox, 15; Erie, 11.8; Dyberry, 6.5; Pittsburgh, 5.3.

*Utah.*—Ogden, 8.5; Salt Lake City, 6.7.

*Vermont.*—Jacksonville, 29; Newport, 23.9; Strafford, 21; Chelsea, 17.4; Charlotte, 16; Woodstock, 15.2; Windsor, 14.3; Burlington, 13.5; Dorset and Townshend, 13.2; Lunenburg, 11; Marlborough, 9.9; Vernon and Brattleborough, 8; Poultney, 7.2.

*Wisconsin.*—Manitowoc, 23.7; Milwaukee, 23.3; Embarras, 22.8; Wausau, 18.2; Madison, 17.5; Prairie du Chien, 12.5; La Crosse, 14.4.

Table of excessive and greatest monthly precipitation for December, 1885.

Station.	Specially heavy.		Largest monthly.	Station.	Specially heavy.		Largest monthly.
	Date.	Amt.			Date.	Amt.	
<i>Alabama.</i>				<i>New Jersey.</i>			
Gadsden .....	8, 9	3.60	6.25	Vineland .....	14	2.17	
Do .....	12, 13	2.50		Dover .....	14	2.25	
Greensborough .....	9	2.54		Paterson .....	13, 14	2.03	
Do .....	12, 13	2.01		Sandy Hook .....	13, 14	2.34	
Birmingham .....	8, 9	2.00		Atlantic City .....	13, 14	2.16	
Mobile .....	13	4.18		<i>New York.</i>			
Montgomery .....	13	2.08		David's Island .....	13, 14	2.00	
Carrollton .....	8	2.55		<i>North Carolina.</i>			
Centre .....	9	2.60		Kitty Hawk .....	9, 10	2.38	6.59
Do .....	13	3.25		Weldon .....	13, 14	2.00	
Newton .....	5, 9	2.50		Wake Forest .....	13, 14	2.11	
Prattville .....	13	3.10		Smithville .....	9, 10	2.25	
Valley Head .....	8	2.01		Fort Macon .....	9, 10	2.29	
<i>California.</i>				<i>Ohio.</i>			
Delta .....			12.94	Clyde .....	9	2.00	
Redding .....			8.80	Do .....	13	3.00	
Emigrant Gap .....			7.38	Toledo .....	8, 9	2.05	
Towles .....			7.00	<i>Oregon.</i>			
Colfax .....			6.77	Bandon .....	9	3.00	13.27
San Rafael .....	21 to 26	6.45	6.59	Do .....	21	3.49	
Oroville .....	21	2.20		Astoria .....	17, 18	2.17	9.85
Nicolaus .....	21	2.38		Eola .....	16, 17	2.03	7.41
Princeton .....	24, 25	2.37		Portland .....	17	2.26	7.17
Presidio of S. F. .....	21	2.94		Albany .....			7.04
Fort Mason .....	30	4.00		Roseburg .....			6.52
Angel Island .....	21	3.02		East Portland .....	20	2.06	
Benicia Barracks .....	25	3.34		Do .....	31	2.07	
Sacramento .....	21	2.81		<i>Pennsylvania.</i>			
Do .....	24, 25, 26	2.45		West Chester .....	13, 14	2.01	
Red Bluff .....	21	2.01		Wellsborough .....	13	2.84	
<i>Florida.</i>				Mahanoy Plane .....	13	2.08	
Jacksonville .....	9, 10	4.46	7.76	<i>South Carolina.</i>			
Do .....	12, 13	2.08		Charleston .....	9, 10	4.04	6.30
Cedar Keys .....	9, 10	2.08		<i>Tennessee.</i>			
Pensacola .....	13	4.73		Knoxville .....	13	2.09	
<i>Georgia.</i>				<i>Texas.</i>			
Savannah .....	9, 10	3.76		Huntsville .....	12	2.43	
Quitman .....	9, 10	2.00		Austin .....	12, 13	2.36	
<i>Illinois.</i>				Corsicana .....	12	2.66	
Charleston .....	8, 9	2.25		New Ulm .....	12	2.85	
<i>Indiana.</i>				<i>Virginia.</i>			
Greencastle .....	8	2.18		Fort Monroe .....	13, 14	2.42	
<i>Louisiana.</i>				Chincoteague .....	13, 14	2.05	
Morgan City .....			6.10	Washington Ter. .....			
Ashton Plantation .....	12	3.25		Neah Bay .....	15, 16	2.80	13.00
New Orleans .....	13	3.20		Do .....	23, 24	2.65	
<i>Maine.</i>				Fort Cauby .....			10.56
Eastport .....	14, 15	2.26		Tatoosh Island .....	23, 24, 25	3.26	10.14
<i>New Hampshire.</i>				Pysht .....			7.93
Mt. Washington .....	9, 10	2.23		Bainbridge Isl'd .....	23, 24, 25	3.10	6.22
				Tacoma .....			6.13

#### DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

*Arizona.*—Prescott, 0.2.

*Colorado.*—Braddock, 31; Pike's Peak, 18; Denver, 4; Montrose, 2.

*Dakota.*—Fort Totten, 4; Bismarck, 2.4; Deadwood, 2.1; Fort Buford, trace.

*Idaho.*—Lewiston, 2.5.

*Iowa.*—West Union, 2; Cresco, 1.5; Guttenberg and Independence, 1; Dubuque, 0.5; Monticello, drifts; Manchester and Bancroft, trace.

*Maine.*—Orono, 6; Gardiner and Buckfield, 3; Eastport and Kent's Hill, 0.5.

*Michigan.*—Escanaba, 6; Marquette, 5; Manistique, 2; Alpena, 0.5; Grand Haven, trace.

*Minnesota.*—Saint Vincent, 4; Moorhead, 0.4; Saint Paul, 0.2.

*Montana.*—Fort Assinaboine, 1.6; Helena and Poplar River, 0.5.

*Nebraska.*—Marquette, 1; Stockham, 0.8; De Soto, 0.5.

*New Hampshire.*—Mount Washington, 22.

*New York.*—Humphrey, drifts; Oswego, Le Roy, Palermo, and North Volney, trace.

*Pennsylvania.*—Drifton, Dyberry, and Grampian Hills, trace.

*Utah.*—Salt Lake City, 0.2.

*Vermont.*—Post Mills, 4; Stowe, 3; Strafford, 2; Dorset, trace.

*Washington Territory.*—Port Angeles, 1; Olympia, 0.5; Kenewick, trace.

*Wisconsin.*—Wausau, 7; Embarras, 4.5; Madison, 3.5; Manitowoc, 1.5; La Crosse, 1.

*Wyoming.*—Fort Bridger, 0.4.

#### HAIL.

Hail is reported to have occurred, as follows:

*Alabama.*—Birmingham and Greensborough, 1st.

*Arkansas.*—Little Rock, 8th.

*Colorado.*—Denver, 7th.

*Dakota.*—Webster, 28th.

*District of Columbia.*—Washington City, 23d.

*Florida.*—Fort Saint Augustine and Archer, 2d.

*Indiana.*—Vevay, 4th, 17th.

*Iowa.*—Monticello, 8th.

*Louisiana.*—Shreveport, 8th.

*Maine.*—Bar Harbor, 26th, 27th.

*Maryland.*—Ocean City, 5th.

*Michigan.*—Grand Haven, 8th; Pentwater, 9th.

*New Jersey.*—Dover, 3d.

*New York.*—Factoryville and Mountainville, 8th; Albany, 22d.

*Ohio.*—Jacksonborough, 8th; Sandusky, 28th.

*Oregon.*—Astoria, 3d; Bandon, 30th, 31st.

*Texas.*—San Antonio, 12th.

*Virginia.*—Chincoteague and Bird's Nest, 3d.

*Washington Territory.*—Pysht and Tatoosh Island, 17th.

#### SLEET.

Sleet fell in the various states and territories during the month, as follows:

*Alabama.*—Greensborough, 1st.

*Arkansas.*—Fort Smith and Lead Hill, 12th.

*California.*—Fort Bidwell, 30th.

*Dakota.*—Bismarck, 24th, 25th.

*Georgia.*—Savannah, 2d.

*Idaho.*—Boisé City, 6th, 7th, 16th.

*Illinois.*—Riley, 4th; Windsor, 7th; Springfield and Philo, 8th; Charleston, 8th, 9th.

*Indiana.*—Terre Haute, 7th; Greencastle, Sunman, Indianapolis, and Guilford, 8th.

*Iowa.*—Keokuk and Dubuque, 8th.

*Kansas.*—Leavenworth, 7th; Fort Scott, Wyandotte, Manhattan, and Richmond, 8th.

*Maine.*—Eastport, 27th.

*Massachusetts.*—Boston, 8th, 9th.

*Michigan.*—Kalamazoo, 4th; Grand Haven, 8th, 9th; Mackinaw City, 9th; Escanaba, 18th, 27th; Port Huron, 27th; Detroit, 28th.

*Minnesota.*—Northfield, 4th; Saint Vincent, 22d.

*Missouri.*—Frankford, 6th; Saint Louis, 7th, 8th; Lamar, 8th.

*New York.*—Setauket and New York City, 1st; Buffalo, 8th; Albany, 8th, 9th; Oswego, 10th; Rochester, 13th; Palmyra, 19th; Syracuse, 28th.

*North Carolina.*—Lenoir, 8th, 13th; Reidsville, 22d.

*Ohio.*—Columbus, Portsmouth, Napoleon, and Yellow Springs, 8th; Hiram, 8th, 27th; Toledo, 8th, 28th; Wauseon, 8th, 29th; Jacksonborough, 13th; Cleveland and Cincinnati, 13th, 28th; Garrettsville and Clyde, 28th.

*Oregon.*—East Portland, 30th.

*Pennsylvania.*—Pittsburg, 4th, 28th; Dyberry, 8th; Grampian Hills, 9th.

*South Carolina.*—Spartanburg, 2d, 13th; Pacolet, 25th.

Washington Territory.—Walla Walla, 11th; Neah Bay, 16th, 17th, 30th; Pleasant Grove, 16th, 18th.

Wisconsin.—La Crosse, 4th; Milwaukee, 8th, 9th; Madison, 27th, 28th.

Wyoming.—Fort Bridger, 21st.

#### PRECIPITATION FROM A CLOUDLESS SKY.

Cincinnati, Ohio: fine snow fell from a cloudless sky from 10.21 to 10.42 p. m. of the 6th.

#### TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for December, 1885.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey .....	45.6	35.2	7.4	13.0	36.9
Alpena, Michigan* .....	34.0	30.5	3.5	12.7	34.3
Augusta, Georgia .....	52.5	42.9	9.6	10.1	45.0
Baltimore, Maryland .....	45.3	35.3	9.0	9.6	37.6
Block Island, Rhode Island .....	46.4	35.5	10.9	8.6	39.7
Boston, Massachusetts* .....	39.4	31.8	7.6	20.7	32.8
Buffalo, New York .....	37.0	31.0	6.0	11.5	30.0
Canby, Fort, Washington Territory .....	50.8	44.6	15.8	28.8	46.7
Cedar Keys, Florida .....	60.0	47.8	12.2	7.8	52.8
Charleston, South Carolina .....	54.8	47.1	7.7	39.6	50.4
Chicago, Illinois † .....	34.1	32.3	1.8	8.3	31.1
Chincoteague, Virginia .....	45.6	33.0	12.6	3.3	40.4
Cleveland, Ohio* .....	38.8	32.2	6.6	14.0	31.5
Detroit, Michigan .....	38.4	34.6	3.8	24.8	32.9
Duluth, Minnesota .....	38.8	34.1	4.7	10.2	19.2
Eastport, Maine .....	46.0	39.4	6.6	16.5	27.8
Escanaba, Michigan* .....	38.6	33.7	4.9	17.8	22.8
Galveston, Texas .....	62.0	47.3	14.7	12.6	57.6
Grand Haven, Michigan* .....	37.1	32.0	5.1	19.0	28.5
Indianola, Texas .....	63.8	48.5	15.3	7.9	58.5
Jacksonville, Florida .....	59.0	52.5	6.5	18.0	53.3
Key West, Florida .....	76.0	60.1	15.9	17.8	64.7
Mackinaw City, Michigan .....	39.4	32.0	7.4	10.0	27.1
Macon, Fort, North Carolina .....	57.0	43.5	13.5	12.2	47.0
Marquette, Michigan* .....	38.5	32.4	6.1	12.7	23.4
Milwaukee, Wisconsin* .....	39.4	34.0	4.8	8.0	26.3
Mobile, Alabama .....	55.0	46.6	8.4	15.8	49.5
New Haven, Connecticut .....	40.0	30.7	9.3	15.2	33.8
New London, Connecticut .....	44.0	33.5	10.5	17.3	36.0
New York City .....	46.7	40.9	5.8	16.6	43.2
Norfolk, Virginia .....	62.6	49.4	13.2	17.2	50.5
Pensacola, Florida .....	40.9	36.7	4.2	17.4	27.2
Portland, Maine .....	48.7	41.6	7.1	51.4	43.0
Portland, Oregon .....	37.0	33.2	3.8	11.0	31.6
Sandusky, Ohio .....	45.3	38.8	6.5	2.1	37.0
Sandy Hook, New Jersey .....	56.7	54.0	2.7	38.5	53.5
San Francisco, California .....	52.1	42.7	9.4	10.3	51.1
Savannah, Georgia .....	54.9	46.5	8.4	10.7	46.5
Smithville, North Carolina .....	36.1	32.3	3.8	12.8	30.2
Toledo, Ohio .....					
Wilmington, North Carolina .....					

\* Observations interrupted by ice; see text. † Instrument broken from 1st to 23d.

Observations were interrupted by ice during the month, as follows: Alpena, Michigan, from 6th to 21st; Boston, Massachusetts, from 7th to 31st; Cleveland, Ohio, on 3d, 5th, 7th, 8th, from 12th to 17th, on 19th and 20th; Detroit, Michigan, from 8th to 29th; Escanaba, Michigan, from 8th to 31st; Grand Haven, Michigan, on 7th and 8th. Marquette, Michigan, on 7th, 8th, and from 14th to 17th; Milwaukee, Wisconsin, from 6th to 31st; Toledo, Ohio, from 7th to 23d, and from 26th to 31st.

#### WINDS.

The most frequent directions of the wind during December, 1885, are shown on chart ii by the arrows flying with the wind; they are also given in the tables of miscellaneous data. In the Lake region, Ohio Valley, and Tennessee, and in the districts on the Atlantic coast, the prevailing winds were generally from northwest to southwest; in the Missouri Valley they were northwesterly; in the Gulf States, Rocky Mountain regions, and on the Pacific coast they were variable.

#### HIGH WINDS.

[In miles per hour.]

Wind-velocities of fifty or more miles per hour were reported during the month, as follows:

Mount Washington, New Hampshire, 80, nw., 3d; 74, nw., 4th; 76, nw., 5th; 90, w., 6th; 79, w., 7th; 76, nw., 8th; 96, sw., 9th; 84, w., 10th; 93, nw., 11th; 80, nw., 12th; 92, se., 13th; 80, nw., 14th; 90, nw., 15th; 50, sw., 18th; 88, nw., 20th; 70, nw., 21st; 65, w., 22d; 85, nw., 23d; 80, n., 24th; 56, n., 25th; 74, ne., 26th; 68, ne., 27th; 73, nw., 28th; 96, nw., 29th; 50, nw., 30th; 61, se., 31st.

Pike's Peak, Colorado, 88, nw., 3d; 69, nw., 4th; 56, nw., 5th; 78, nw., 6th; 76, w., 7th; 54, nw., 11th; 52, nw., 12th; 64, sw., 15th; 84, w., 16th; 76, nw., 17th; 90, w., 22d; 56, sw., 25th; 60, sw., 26th; 60, w., 27th.

New York City, 50, w., 8th.

Grand Haven, Michigan, 50, nw., 18th.

Barneget City, New Jersey, 52, nw., 7th; 52, ne., 26th.

Sandy Hook, New Jersey, 55, nw., 5th; 54, nw., 7th; 51, n., 26th; 52, n., 27th.

Fort Buford, Dakota, 60, w., 3d; 55, w., 4th.

Poplar River, Montana, 56, nw., 3d.

Fort Shaw, Montana, 56, w., 3d.

Fort Benton, Montana, 57, sw., 3d.

Kitty Hawk, North Carolina, 56, n., 25th; 65, ne., 26th.

Fort Macon, North Carolina, 52, sw., 5th; 52, n., 26th.

Palestine, Texas, 52, nw., 4th.

Cape Henry, Virginia, 50, n., 15th; 53, n., 26th.

Chincoteague, Virginia, 54, n., 26th.

Omaha, Nebraska, 50, nw., 4th.

Cheyenne, Wyoming, 52, nw., 22d.

Block Island, Rhode Island, 60, ne., 26th.

Saint Louis, Missouri, 60, nw., 4th.

Moorhead, Minnesota, 50, s., 26th.

Sandusky, Ohio, 56, nw., 5th.

Fort Sill, Indian Territory, 53, n., 4th.

Fort Elliott, Texas, 64, nw., 4th.

Tatoosh Island, Washington Territory, 51, w., 30th.

Cape Mendocino, California, 62, se., 15th; 76, se., 20th; 84, se., 21st; 84, se., 22d; 100, se., 23d; 104, se., 24th; 84, se., 25th.

#### LOCAL STORMS AND TORNADOES.

Little Rock, Arkansas: a tornado, of limited extent, occurred two and a half miles west of this place on the afternoon of the 8th, moving from southwest towards the northeast, causing but slight damage.

The following is from the "La Crosse (Wisconsin) Daily Republican," of December 17, 1885:

PANAMA, December 17.—Colon has been visited by a severe cyclone, which has done considerable damage. It commenced on the 2d instant, about 2 p. m., and the next day lulled, but commenced again with terrible severity. All the steamers in port put out to sea for safety, returned, and had to put out again. The damage to property has been very heavy, and the loss of life most serious. The following vessels were sunk with their crews: "Holden," "Karnan," "Blanche," "Oataton," "Atwood," "Ariel," "Veteran," "Ocean," "Lynton," "Avelina," "Stella," "Catatina," "Figri," "Douglas," and two others whose names could not be ascertained.

The rain poured down in torrents, and a terrible gale of wind set in from the northeast. The "Royal Mail's" new freight office was destroyed by the storm. Wharf number four, belonging to the Panama railroad, was almost demolished, the rails having been torn up and the earthworks destroyed by the force of the tornado.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

The Mississippi River froze at Saint Paul, Minnesota, on the 6th and at La Crosse, Wisconsin, on the 7th; at Dubuque, Iowa, it was frozen from the 8th to 31st; Davenport, Iowa, 8th to 26th, and Keokuk, Iowa, 13th to 22d. At Saint Louis, Missouri, the river fell to 2.1 feet on the 16th and 17th, being the lowest stage of water at that place in the record of the Signal Service.

The Missouri River froze at Fort Buford and Yankton, Dakota, on the 9th; Bismarck and Fort Yates, Dakota, on the 6th, and at Fort Sully, Dakota on the 8th; at Omaha, Nebraska, it was frozen from the 10th to 28th, and at Leavenworth, Kansas, from the 12th to 15th, and 17th to 21st.

In the following table are shown the danger-points at the



various river stations; the highest and lowest stages for December, 1885, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, December, 1885.  
[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	20, 21	5.7	8	1.7	4.0
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	30	5.0	19 to 22	2.1	2.9
Little Rock, Arkansas.....	23.0	31	3.5	26 to 29	2.7	0.8
<i>Missouri River:</i>						
Yankton, Dakota *.....	24.0	1 to 4	10.7	5 to 8	10.6	0.1
Omaha, Nebraska *.....	18.0	20	5.9	9, 26	5.3	0.6
Leavenworth, Kansas *.....	30.0	28	7.3	24	4.8	2.5
<i>Mississippi River:</i>						
Saint Paul, Minnesota *.....	14.5	2 to 5	2.1	1	2.0	0.1
La Crosse, Wisconsin.....	24.0	24, 25, 26	5.4	6	3.0	2.4
Dubuque, Iowa *.....	16.0	1, 2	3.5	8	2.1	1.4
Davenport, Iowa *.....	15.0	30, 31	7.0	6	2.5	4.5
Keokuk, Iowa *.....	14.0	23	6.5	11	0.0	6.5
Saint Louis, Missouri.....	32.0	1	9.2	16, 17	2.1	7.1
Cairo, Illinois.....	40.0	22	24.8	8, 9	14.6	10.2
Memphis, Tennessee.....	34.0	24, 25	17.0	3	9.2	7.8
Vicksburg, Mississippi.....	41.0	29, 30	20.0	12, 14, 15	10.9	9.1
New Orleans, Louisiana.....	13.0	31	5.8	7, 15, 16, 17, 19, 20	3.0	2.8
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	11	12.1	8, 9	3.0	9.1
Cincinnati, Ohio.....	50.0	17	30.2	12	12.5	17.7
Louisville, Kentucky.....	25.0	18	11.4	7, 8	6.7	4.7
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	24, 25	17.0	3	9.2	7.8
<i>Tennessee River:</i>						
Knoxville, Tennessee †.....		17	5.6	30	1.8	3.8
Chattanooga, Tennessee.....	33.0	16	21.4	2	4.6	16.8
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	11	12.1	8, 9	3.0	9.1
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	15	18.6	8	7.7	10.9
<i>Mobile River:</i>						
Mobile, Alabama.....		8, 13	16.8	5	14.8	2.0
<i>Sacramento River:</i>						
Red Bluff, California.....		26	21.1	15, 16	2.4	18.7
Sacramento, California.....		30, 31	23.9	30	17.2	6.7
<i>Willamette River:</i>						
Portland, Oregon.....		19	9.7	4, 5	3.2	6.5
<i>Colorado River:</i>						
Yuma, Arizona.....		1	16.0	30, 31	14.6	1.4

\* Observations interrupted by ice; see text. † Observations commenced December 17th.

NOTE.—The zero of river-gauge at New Orleans was changed on November 1, 1885, from high-water of 1874 to low-water of 1876. This change makes the readings 16.2 feet lower than those made previous to November 1, 1885.

#### ICE IN RIVERS AND HARBORS.

**New Haven Harbor.**—New Haven, Connecticut: harbor frozen over on the 8th.

**Hudson River.**—Menand Station (near Albany), New York: navigation closed on the 8th; on 10th ice passed out of river, which remained open until 28th.

Albany, New York: floating ice, 10th to 26th; river frozen over on the 7th, 8th, 9th, 27th to 31st. Navigation on the canal closed on the 1st.

Rondout, Ulster county: on the 29th the river was closed between Albany and Castleton.

New York City: floating ice observed in river on 28th, 29th, 30th.

**Potomac River.**—Fort Myer, Virginia: river froze over on the 8th.

**Oswego River.**—Oswego, New York: the schooner "Herbert Dudley" left for Kingston, Ontario, on the 18th, being the last departure of the season.

**Niagara River.**—Buffalo, New York: floating ice in the river on the 6th.

**Lake Erie.**—Buffalo, New York: the steamer "Nassau" left for Cleveland on the 13th, being the last departure of the season; the steamer "Oceanic," of the Lehigh Valley Transportation Company, arrived on the 25th from Chicago, being the first instance in many years of so late an arrival; the captain reported but little ice on Lake Erie.

**Presque Isle Bay.**—Erie, Pennsylvania: the bay was frozen over on the 7th.

**Cuyahoga River.**—Cleveland, Ohio: river froze on the 7th.

**Sandusky Bay.**—Sandusky, Ohio: ice formed in the bay on

the 6th; bay frozen and navigation closed for the season on the 7th.

**Maumee River.**—Toledo, Ohio: floating ice on the 6th; the river froze over on the 7th.

**Detroit River.**—Detroit, Michigan: floating ice in the river from the 7th to 11th and from the 14th to 29th.

**Black River.**—Port Huron, Michigan: Black River frozen over on the 7th; the steam-barge "Chauncey Hurlbert" left for Detroit on the 13th, being the last departure of the season.

**Grand River.**—Grand Haven, Michigan: river frozen on the 7th; clear of ice on the 9th.

**Thunder Bay and Thunder Bay River.**—Alpena, Michigan: river frozen from 6th to 21st; bay partly frozen, 7th, 8th, 18th; river clear of ice, 22d; floating ice in the river and bay, 23d to 30th.

**Strait of Mackinac.**—Mackinaw City, Michigan: the steam barges "H. E. Packer" and "Fred Mercier," of the Lehigh Valley line, from Buffalo to Chicago, passed through the strait on the 25th. This is the first time in twenty years that a vessel has passed through the strait at so late a date.

**Little Bay De Noquet.**—Escanaba, Michigan: the propeller "F. H. Fairbank" left for Cleveland, Ohio, on the 1st, being the last departure of the season. Ice formed on the shore of the bay 1st to 21st, 23d to 27th, 29th, 31st.

**Lake Michigan.**—Chicago, Illinois: considerable ice in the river and harbor, 7th to 23d.

Manistique, Schoolcraft county, Michigan: the last boat of the season left on the 10th. Neither Manistique Harbor nor Lake Michigan was closed by ice during the month.

**Milwaukee River.**—Milwaukee, Wisconsin: river froze on the 6th.

**Manitowoc River.**—Manitowoc, Wisconsin: river frozen on the 5th.

**Lake Superior.**—Marquette, Michigan: ice in bay broke up on 9th; bay frozen on 12th; ice broke on 13th.

**Duluth Bay.**—Duluth, Minnesota: bay frozen from 3d to 31st.

**Des Moines River.**—Oskaloosa, Mahaska county, Iowa: river closed on the 6th.

**Ohio River.**—Pittsburg, Pennsylvania: floating ice, 6th to 18th, 29th, 30th.

Portsmouth, Ohio: floating ice, 14th.

Cincinnati, Ohio: floating ice, 16th.

Cairo, Illinois: floating ice, 17th, 18th.

**Mississippi River.**—Saint Paul, Minnesota: floating ice observed in the river on 5th; ice-dam formed on 6th.

Red Wing, Minnesota: river froze on the 5th.

La Crosse, Wisconsin: the steamer "Percy Swain," the last boat of the season, arrived on the 1st and went into winter quarters; the first light floating ice in the river observed on 4th; heavy floating ice on 5th, 6th; the ferry boat "Warsaw" made her last trip on 9th; ice stopped running and navigation closed 7th; teams crossed on the ice 10th; river partially clear of ice, along the Wisconsin shore, from 23d to 31st.

Dubuque, Iowa: floating ice, 5th, 6th; river frozen 8th, 31st. Davenport, Iowa: floating ice, 5th, 6th, 22d, 24th, 25th, 28th to 31st; river frozen, 8th, 26th.

Keokuk, Iowa: floating ice from 5th to 13th, 23d to 27th, 31st; the Warsaw packet "Patience," went into winter quarters on the 6th, closing navigation for the season; river frozen from the 13th to 22d.

Cairo, Illinois: floating ice from 14th to 19th; navigation suspended between this place and Saint Louis from the 7th to the 23d, owing to heavy floating ice.

**Missouri River.**—Fort Buford, Dakota: floating ice in the river from the 2d to 8th; river frozen on the 9th.

Bismarck, Dakota: river frozen on 6th.

Fort Yates, Dakota: floating ice, 4th, 5th; river frozen, 6th.

Fort Sully, Dakota: running ice in the river, 4th to 7th; river frozen on the 8th.

Yankton, Dakota: river frozen on the 9th.

Omaha, Nebraska: river frozen on the 10th; ice broke up on the 28th.

Leavenworth, Kansas: floating ice on the river, 6th to 11th, 22d to 24th, 27th, 28th; river frozen, 12th to 15th, 17th to 21st.

*Miscellaneous.*—Mr. Wm. G. Yetter, voluntary observer at Catawissa, Columbia county, Pennsylvania, reports that navigation on the north branch of the Pennsylvania canal was closed by ice on the 7th.

Mr. Geo. S. Truman, voluntary observer at Genoa, Nance county, Nebraska, reports that the unusually mild weather during the last half of December caused the ice to break up in the Loup and Platte Rivers; considerable damage was done to the bridges at Columbus, Platte county.

#### FLOODS.

*California.*—San Francisco: the heavy rainfall of the 21st caused considerable damage by flood; in some parts of the city the water was four feet deep; cellars in the business portion of the city were flooded, damaging the goods contained in them, and entailing a loss of several thousand dollars.

Delta, Shasta county: the railroad track was washed out at numerous places between Tunnel No. 5 and Delta on the 25th; the Sacramento River, and all streams, are unusually high.

Yreka, Siskiyou county: the streams overflowed in consequence of the heavy rains of the 24th and 25th.

Redding, Shasta county: the Sacramento River rose eighteen feet on the 24th, and was higher than at any time since 1880. Considerable damage was done along the line of the railroad in this vicinity.

Marysville, Yuba county: the Yuba River reached a height of fourteen feet on the 25th, the highest point reached this season; the Feather River was also correspondingly high.

*West Virginia.*—Grantsville, Calhoun county: a sudden rise in the West Fork, a tributary of the Little Kanawha River, on the 29th, caused a great amount of damage; the Pennsylvania Lumber Company lost two saw-mills and \$10,000 worth of lumber.

#### HIGH TIDES.

Norfolk, Virginia: an unusually high tide occurred on the morning of the 2d, flooding the lower part of the city.

Indianola, Texas: a very high tide occurred on the 12th; the flats and lower part of the town were submerged.

Cohasset, Norfolk county, Massachusetts: an unusually high tide occurred on the 26th; much damage was done to property along the shore.

Nantasket, Norfolk county, Massachusetts: the water reached a higher point on the 26th than during the unusually high tides of November, 1885.

Sandwich, Barnstable county, Massachusetts: the highest tide ever known occurred on the 26th. Many streets were flooded to the depth of eight feet, doing much damage.

Very high tides occurred at Gloucester and Rockport, Essex county, Wellfleet, Barnstable county, Hingham, Plymouth county, Massachusetts, on the 26th, causing much damage along the coast.

Norfolk, Virginia: the highest tide since 1876 occurred on the 26th.

Cape Henry, Virginia: the highest tide in seven years occurred on the 26th.

Kitty Hawk, North Carolina: the tide of the 26th was the highest that has occurred in forty years; the sea-coast telegraph line was washed away in places, and much damage done to property in the vicinity of Oregon Inlet, North Carolina, where a dwelling house was carried off its foundation; a large number of cattle were also lost.

High tides were also reported, as follows:

Eastport, Maine, 24th to 27th.

Boston, Massachusetts, 26th.

New Haven, Connecticut, 14th.

Ocean City, Maryland, 26th.

Chincoteague, Virginia, 1st, 2d.

Fort Macon, North Carolina, 4th, 9th, 25th, 26th.

San Francisco, California, 21st.

#### LOW TIDES.

Chincoteague, Virginia, 20th, 21st.

Cedar Keys, Florida, 22d.

Indianola, Texas, 14th, 15th, 16th.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for districts east of the Rocky Mountains during December, 1885, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 81.73 per cent. The percentages for the four elements are: Weather, 85.84; direction of the wind, 79.25; temperature, 77.22; barometer, 87.94 per cent. By geographical districts, they are: For New England, 82.40; middle Atlantic states, 85.17; south Atlantic states, 84.50; eastern Gulf states, 83.78; western Gulf states, 80.14; lower lake region, 80.32; upper lake region, 80.76; Ohio Valley and Tennessee, 81.88; upper Mississippi valley, 82.07; Missouri Valley, 75.98. There were six omissions to predict, out of 3,221, or 0.19 per cent. Of the 3,215 predictions that have been made, one hundred and twenty-six, or 3.92 per cent., are considered to have entirely failed; one hundred and forty-nine, or 4.63 per cent., were one-fourth verified; four hundred and sixty-nine, or 14.59 per cent., were one-half verified; four hundred and sixty, or 14.31 per cent., were three-fourths verified; 2,011, or 62.55 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The percentages of indications verified for the Pacific coast districts, are as follows: General average, 75.71. By elements they are: For weather, 81.82; wind, 70.91; temperature, 74.39. By districts they are: North Pacific coast region, 70.46; middle Pacific coast region, 77.42; south Pacific coast region, 79.24 per cent.

The general average percentage of verifications for all districts is 80.93 per cent.

The percentages of verifications of special predictions for certain localities are, as follows:

Baltimore, Maryland, 90.35; Washington City, 83.33; Erie, Pennsylvania, 66.94; Boston, Massachusetts, 75.81; New Haven, Connecticut, 77.42; Portland, Maine, 75.81; Albany, New York, 78.23; Pittsburg, Pennsylvania, 64.92; Cincinnati, Ohio, 71.77; Louisville, Kentucky, 70.16; Columbus, Ohio, 75.81; Cleveland, Ohio, 65.32; Indianapolis, Indiana, 77.50; Oswego, New York, 78.63; Rochester, New York, 79.44; Buffalo, New York, 77.02; Milwaukee, Wisconsin, 74.59; Chicago, Illinois, 80.74; Detroit, Michigan, 72.98; Toledo, Ohio, 74.19; Sandusky, Ohio, 75.00; Cairo, Illinois, 77.02; Saint Louis, Missouri, 81.50; Memphis, Tennessee, 75.81; Shreveport, Louisiana, 75.81; Iowa, 72.54; Tennessee, 84.68; Florida (thirteen days), 90.38; Omaha, Nebraska (twenty-seven days), 86.11; Arkansas (twenty-seven days), 84.43; Georgia (twenty-seven days), 90.28; New York City (thirty days), 78.33; Philadelphia, Pennsylvania (thirty days), 81.67; Colorado, 68.95.

#### CAUTIONARY SIGNALS.

During December, 1885, one hundred and fifty-seven cautionary signals were ordered. Of these, one hundred and forty-six, or 92.99 per cent., were justified by winds of twenty-five miles or more per hour, at or within one hundred miles of the station. Seventy-three cautionary off-shore signals were ordered, of which number, fifty-nine, or 80.82 per cent., were fully justified, both as to direction and velocity; seventy-one, or 97.25 per cent., were justified as to direction; and sixty, or 82.19 per cent., were justified as to velocity. Two northwest signals were ordered, both of which were justified as to direction and velocity. Two hundred and thirty-two signals of all kinds were ordered, two hundred and seven, or 89.22 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, nineteen were changed from cautionary signals. Nine signals were



ordered late. In ninety-three cases, winds of twenty-five miles or more per hour were reported for which no signals were ordered.

#### COLD-WAVE SIGNALS.

During the month there were one hundred and forty-nine cold-wave signals displayed. Of these, one hundred and thirty-nine, or 93.29 per cent., were justified.

#### RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for December, 1885, states:

The verifications of predictions for the whole area was 88 per cent. for temperature, and 100 per cent. for weather.

The following roads comprise this system: Western of Alabama; South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus Western; Alabama Great Southern; Atlanta and West Point of Georgia; Northeastern of Georgia; Atlanta and Charlotte Air Line; Western and Atlantic; Georgia; East Tennessee, Virginia and Georgia system in Georgia; and Savannah, Florida and Western.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

Auroral displays occurred during December, as follows:

Fort Totten, Dakota: an auroral arch of 25° altitude and 100° azimuth was observed at 9.20 p. m. of the 1st, the display lasting until 4.30 a. m. of the 2d.

Fort Sully, Dakota: a faint aurora, extending from 180° to 195° azimuth, with an altitude of 5°, was observed from 11.25 p. m. to midnight of the 1st.

Escanaba, Michigan: an auroral display was visible from 9.22 to 10.58 p. m. of the 1st, consisting of a dark segment of 15° altitude, bordered by a bright yellow arch 5° in width.

Mount Washington, New Hampshire: a faint auroral light was observed at 9.30 p. m. of the 1st; it gradually increased in extent until 10.10 p. m., when it reached its maximum of 40° azimuth with an altitude of 4°; streamers of a light green color were seen at intervals.

Bismarek, Dakota: an auroral light of a pale yellow color was observed at 10.45 p. m. of the 1st having an altitude of 5°, and extending from 135° to 225° azimuth; the arch was uniform and well defined; no dark segment was observed.

Manistique, Schoolcraft county, Michigan: a moderate auroral arch was observed from 8.30 to 10 p. m. of the 1st, having an altitude of 10° to 15° and extending from 170° to 215° azimuth.

Saint Vincent, Minnesota: an aurora was observed at 9.30 p. m. of the 1st, consisting of a pale, indistinct arch resting on a dark segment of 25° altitude, and extending from 160° to 250° azimuth.

Burlington, Chittenden county, Vermont: an aurora of a light straw color was observed from 12.30 to 1.30 a. m. of the 6th.

Portland, Maine: an aurora was observed from 9.40 to 11.45 p. m. of the 6th, consisting of an arch 5° in altitude and 85° azimuth; it faded away at 10.20 p. m., and reappeared a few moments later as an irregular arch, with two streamers, of about 30° altitude, having but a slight motion.

Cambridge, Middlesex county, Massachusetts: a low auroral arch, above a dark segment, was observed on the 6th.

Duluth, Minnesota: an auroral light, of a pale white color, having an altitude of 20° and extending from 160° to 230° azimuth, was observed at 8.30 p. m. of the 6th. At 9.45 p. m. the color changed to a light green.

Saint Paul, Minnesota: a faint auroral light, of a whitish color, was observed in the northern horizon on the 6th.

Saint Vincent, Minnesota: an aurora was observed at 7.20 p. m. of the 6th; it consisted of a pale whitish arch about 5° in width, and extending from 160° to 270° azimuth, with an altitude of 30°; the lower edge of the arch was well defined, beneath which a dark segment was plainly visible. The display continued until daylight of the 7th.

Tatoosh Island, Washington Territory: an aurora was observed from 2.15 to 4.00 a. m. of the 7th, consisting of a bluish-

white color of 5° altitude, with a few slender beams shooting up to an altitude of 15°; the arch was bounded on the east and west by dense stratus clouds.

Manistique, Schoolcraft county, Michigan: an aurora, having a moderate diffused light, was observed at 12.18 a. m. of the 8th, having an altitude varying from 8° to 22° and 160° to 220° azimuth. The display lasted until daylight.

Escanaba, Michigan: an aurora of a pale yellow color was observed at 9.19 p. m. of the 6th; the display was very faint, and disappeared at 11.49 p. m.

Prairie du Chien, Crawford county, Wisconsin: an aurora of a whitish color, low in the sky, and 9° east of the magnetic pole, was observed from 9 to 10 p. m. of the 6th.

Saint Vincent, Minnesota: a faint auroral light was observed in the north at 7.45 p. m. of the 7th, continuing until after midnight.

Fort Totten, Dakota: an auroral display was visible from 9 p. m. of the 8th to 3 a. m. of the 9th, consisting of two arches of 15° and 20°, reaching its maximum intensity at 2 a. m.

Saint Vincent, Minnesota: an aurora, consisting of two parallel arches about 3° apart, and extending from 150° to 260° azimuth, with an altitude of 20°, was observed at 8.15 p. m. of the 8th. The lower arch was well defined, while the upper one was somewhat indistinct. The display continued until the morning of the 9th.

Other auroral displays were observed during the month, as follows:

1st.—Mackinaw City and Traverse City, Michigan; Gardiner and Kent's Hill, Maine; Winnipeg, Manitoba; Sydney, Nova Scotia; Charlottetown, Prince Edward's Island.

2d.—Mackinaw City, Michigan; Winnipeg, Manitoba.

4th.—Winnipeg, Manitoba.

5th.—Embarras, Wisconsin.

6th.—Boston, Massachusetts; Escanaba, Michigan; Moorhead, Albert Lea, and Sherburne, Minnesota; Fort Benton, Montana; Webster and Fort Totten, Dakota; Bancroft, West Union, and Cresco, Iowa; Gardiner, Cornish, and Kent's Hill, Maine; Nashua, New Hampshire; Embarras and Madison, Wisconsin; Winnipeg, Manitoba; Sydney, Nova Scotia; Charlottetown, Prince Edward Island.

7th.—Marquette, Michigan; Moorhead, Minnesota; Independence, Iowa; Gardiner, Kent's Hill, Cornish, and Orono, Maine; Cambridge, Westborough, and Fall River, Massachusetts; Newport, Vermont; Embarras, Wisconsin; Toronto, Ontario; Sydney, Nova Scotia.

8th.—Fort Totten and Webster, Dakota; Orono, Maine; Winnipeg, Manitoba.

9th.—Kent's Hill, Maine.

17th, 26th, 29th.—Winnipeg, Manitoba.

30th.—Lansing, Michigan.

##### THUNDER-STORMS.

Thunder-storms were reported in the various states and territories, as follows:

Alabama.—Mobile and Greensborough, 8th; Montgomery and Birmingham, 9th.

Arizona.—Fort Apache and Tucson, 8th; Fort Grant, 7th, 8th; Fort Bowie, 27th.

Arkansas.—Little Rock and Lead Hill, 8th.

Colorado.—Montrose, 31st.

Florida.—Archer, 2d, 9th, 13th, 26th; Sanford, 2d, 10th; Tallahassee, Jacksonville, and Cedar Keys, 9th; Key West, 9th, 14th; Pensacola, 13th.

Georgia.—Atlanta and Savannah, 9th.

Illinois.—Windsor, 4th, 8th; Cairo, Anna, Bunker Hill, and Collinsville, 8th; Chicago, 9th.

Indiana.—Greencastle, Indianapolis, and Terre Haute, 8th.

Louisiana.—Point Pleasant and Shreveport, 8th; Grand Coteau, 12th; New Orleans, 13th; Morgan City, 24th.

Massachusetts.—Fall River, 19th.

Mississippi.—Vicksburg, 8th, 9th.

Missouri.—Centreville, 9th.

New Mexico.—Santa Fé, 27th.

Table of miscellaneous meteorological data for December, 1885—Signal Service observations.

Stations.	Elevation above sea-level.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).										Winds.															
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.		Monthly range.	Greatest.	Least.	Date.	Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.		Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.			
					Highest barometer.	Lowest barometer.				Max.	Min.											Miles p. h.	Direction.								
					Date.	Date.				Date.	Date.											Date.	Date.								
<b>New England.</b>																															
Eastport	61	29.60	-.12	29.87	30.68	12 28.92	51.76	27.8	+2.7	52.9	10 34.4	7.4	18.8	45.5	31.2	6.0	276.9	21.5	5.90	+2.00	10.005	nw.	43	n.	26	16	15	13	3		
Portland	99	29.81	-.10	29.92	30.68	12 28.97	51.71	27.2	+2.3	55.3	10 34.6	6.6	19.6	48.7	30.6	5.4	1776.8	20.7	2.94	-0.20	6.549	w.	36	w.	7	16	10	14	7		
Mount Washington	6,279	23.37	.....	30.00	30.60	12 29.25	51.35	10.1	+1.0	41.8	10 18.8	16.1	1.5	57.9	34.5	5.7	295.0	9.0	4.83	-0.57	30.010	nw.	96	sw.	9	22	4	18	9		
Boston	125	29.80	-.12	29.92	30.70	12 29.09	51.61	32.8	+2.8	61.5	9 40.7	11.8	24.6	49.7	31.6	6.9	1767.0	22.8	2.09	-1.54	10.856	w.	48	w.	7	14	12	11	8		
Block Island	27	29.93	.....	29.96	30.71	12 29.13	51.58	35.7	+0.6	57.4	9 43.4	17.4	30.7	40.0	31.5	8.9	4.9	1280.5	31.3	4.68	-0.07	15.601	nw.	60	ne.	25	15	11	6	4	
Narragansett Pier	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
New Haven	107	29.87	.....	29.98	30.71	12 29.14	51.57	33.3	+3.3	58.4	10 41.5	10.3	25.2	46.1	27.1	9	6.0	168.8	23.8	3.31	-0.30	7.380	w.	31	w.	7	10	12	15	4	
New London	47	29.94	.....	29.98	30.73	12 29.16	51.57	35.0	.....	58.8	10 42.0	14.4	27.9	44.4	24.6	13	5.0	172.0	26.7	3.92	-0.30	6.573	nw.	45	se.	13	13	10	12	9	
<b>Middle Atlantic States.</b>																															
Albany	83	29.92	-.09	30.01	30.74	12 29.13	51.61	30.2	+1.7	57.5	10 38.0	9.2	23.5	48.3	28.9	9	4.4	31.7	23.0	1.51	-1.24	6.559	n.	28	w.	7	13	18	11	2	
New York City	104	29.83	-.10	30.00	30.72	12 29.19	51.53	35.0	+2.9	60.1	10 44.4	14.1	29.4	46.6	25.8	5	6.5	169.0	26.5	2.69	-0.52	9.794	nw.	50	w.	7	7	3	21	7	
Philadelphia	117	29.91	-.10	30.03	30.76	12 29.26	51.50	36.7	+2.3	60.1	9 44.6	14.8	29.5	45.3	29.8	13	5.0	168.3	26.7	2.87	-0.27	9.129	nw.	37	nw.	5	7	6	17	8	
Atlantic City	13	30.00	-.10	30.00	30.71	12 29.25	51.46	36.9	+1.2	53.3	9 44.8	12.5	28.6	40.8	35.0	8	4.8	181.8	31.6	4.29	-0.07	7.766	nw.	40	n.	29	9	5	17	9	
Barnegat City	22	30.00	-.08	30.01	30.73	12 29.24	51.49	38.0	+2.9	59.0	9 45.5	14.1	31.0	41.9	32.6	8	4.0	180.0	32.3	0.61	-3.90	13.188	nw.	52	nw.	7	9	9	12	10	
Cape May	27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Little Egg Harbor	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Sandy Hook	28	29.93	-.10	30.00	30.72	12 29.21	51.51	37.0	+2.0	60.1	9 44.4	16.1	31.2	44.0	24.1	9	5.5	1876.0	30.0	4.33	-0.45	16.063	nw.	55	nw.	5	9	6	18	7	
Cape Henlopen	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Baltimore	45	30.01	-.10	30.05	30.79	12 29.34	51.45	37.6	+0.6	64.4	22 45.9	14.7	31.0	49.7	31.3	21	6.5	161.8	24.9	2.49	-0.68	5.047	nw.	26	nw.	5	6	8	19	4	
Ocean City	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Washington City	106	29.96	-.08	30.06	30.80	12 29.29	51.52	37.5	+1.9	63.9	22 45.8	13.9	7	34.4	50.0	31.8	21	4.1	169.1	27.6	2.07	-0.37	5.244	nw.	28	nw.	5	6	3	19	9
Cape Henry	16	30.03	-.08	30.05	30.74	12 29.33	51.40	43.4	+1.0	67.0	9 51.4	21.9	8	34.4	45.1	32.1	8	4.3	267.4	23.5	3.49	-0.90	12.078	nw.	53	n.	26	6	7	8	16
Chincoteague	8	30.04	-.08	30.04	30.75	12 29.30	51.44	40.4	+1.5	64.5	9 48.9	17.8	8	32.9	46.7	32.6	8	7.4	273.1	32.0	4.16	-0.09	11.881	nw.	54	n.	26	9	7	10	14
Lynchburg	652	29.38	-.05	29.94	30.74	12 29.42	51.33	39.6	+0.9	65.2	22 49.4	15.7	8	32.1	49.8	30.3	18	4.8	166.2	28.3	3.16	-0.75	3.524	nw.	23	w.	19	9	7	10	14
Norfolk	30	30.05	-.07	30.06	30.70	12 29.35	51.35	43.2	+0.8	68.8	9 52.1	22.3	7	34.3	46.5	30.2	8	5.9	169.6	33.1	3.94	-0.10	6.065	n.	32	n.	26	9	5	11	15
<b>South Atlantic States.</b>																															
Charlotte	808	29.26	-.02	30.12	30.69	12 29.50	51.19	42.8	-0.3	66.2	22 52.8	21.0	32.1	46.1	33.2	21	8.9	262.2	29.1	4.71	-0.54	4.572	sw.	28	nw.	5	11	6	12	13	
Fort Macon	11	30.10	-.04	30.08	30.65	12 29.43	51.22	47.0	-1.4	65.2	9 53.5	25.9	27	39.3	39.3	26.5	5	4.4	185.8	42.8	5.98	+1.60	12.580	sw.	52	sw.	5	11	6	12	13
Hatteras	13	30.07	-.05	30.06	30.66	12 29.37	51.29	47.5	+0.2	68.5	9 54.6	28.0	27	40.8	40.8	29.0	8	7.1	977.9	40.5	6.23	-0.19	10.940	w.	48	n.	26	12	10	7	4
Kitty Hawk	9	30.08	-.06	30.07	30.71	12 29.39	51.32	48.4	+0.3	67.7	9 53.1	25.3	27	37.3	42.4	28.3	9	7.4	2470.5	35.0	6.59	+1.35	12.851	w.	65	ne.	26	11	8	11	10
Smithville	34	30.08	-.06	30.08	30.60	12 29.47	51.13	46.3	-1.7	65.2	24 53.4	24.0	27	38.5	41.2	27.5	5	4.7	774.0	38.1	3.51	-0.00	7.085	w.	41	sw.	5	10	6	12	13
Charleston	52	30.10	-.06	30.12	30.58	12 29.56	51.02	50.4	-0.7	70.0	9 58.6	23.0	27	41.3	42.0	25.5	14	8.0	268.7	39.2	6.30	+2.68	5.480	w.	31	w.	5	10	3	14	14
Augusta	183	29.98	-.02	30.14	30.64	12 29.59	51.05	45.5	-1.9	71.9	9 59.2	30.0	27	41.3	42.0	25.5	14	8.0	268.7	39.2	6.30	+2.68	5.480	w.	31	nw.	5	8	5	10	16
Savannah	87	30.08	+.01	30.14	30.56	12 29.59	50.90	51.1	-2.3	71.8	13 61.2	30.0	27	41.3	42.0	25.5	14	8.0	268.7	39.2	6.30	+2.68	5.480	nw.	31	nw.	5	8	5	10	16
Jacksonville	43	30.14	+.03	30.15	30.50	21 29.74	50.77	53.3	-2.7	76.0	9 63.2	32.2	27	44.7	43.8	27.6	28	11.4	267.3	74.4	7.70	+4.78	4.683	nw.	33	w.	5	7	4	15	12
<b>Florida Peninsula.</b>																															
Cedar Key	22	30.14	-.01	30.12	30.45	21 29.80	50.65	52.8	-6.9	73.7	23 60.9	31.0	27	44.9	42.7	25.7	17	7.8	983.7	74.7	3.84	+0.62	6.264	nw.	36	n.	9	8	2	17	12
Key West	20	30.12	+.03	30.09	30.32	21 29.90	50.42	54.7	-5.7	83.0	10 69.2	50.2	27	61.1	32.8	20.3	10	2.5	182.2	58.9	1.72	-0.11	10.938	ne.	42	n.	10	8	9	11	11
Sanford	257	30.16	+.03	30.15	30.49	21 29.88	50.61	55.6	-8.4	84.9	9 66.0	32.0	27	46.6	32.9	31.1	28	8.6	267.3	64.6	1.85	+0.52	4.739	n.	33	n.	26	7	6	13	12
<b>Eastern Gulf States.</b>																															
Atlanta	1,129	28.97	+.00	30.17	30.57	12 29.64	40.93	42.7	-2.6	69.0	9 51.6	21.0	27	34.1	48.0	27.0	5	7.8	261.3	28.6	2.64	-3.38	8.204	w.	36	w.	5	8	3	12	16
Pennacola	30	30.17	+.05	30.16	30.51	11 29.73	40.78	50.5	-4.9	69.4	9 59.4	26.0	27	42.1	41.1	24.1	29	10.2	3070.2	39.8	4.72	-0.64	5.430	nw.	37	sw.	8	5	4	14	13
Mobile	35	30.18	+.05	30.18	30.54	11 29.67	40.87	49.5	-2.6	69.4	8 59.0	26.0	27	40.4	43.4	29.1	6	11.3	2471.7	39.4	5.00	+0.26	6.090	nw.	36	n.	8	4	4	14	13
Montgomery	219	29.95	+.03	30.17	30.58	11 29.67	40.91	46.6	-2.6	70.0	24 57.2	25.0	27	36.5	45.0	32.0	4	10.7	1466.4	34.6	3.13	-2.28	4.132	nw.	32	n.	8	5	8	11	12
Vicksburg	209	29.98	+.04	30.18	30.54	11 29.45	40.89	48.7	-1.6	73.0	8 59.5	22.5	27	39.2	50.5	31.6	3	9.2	161.7	34.6	2.86	-3.01	4.251	e.	33	nw.	4	7	5	13	13
New Orleans	52	30.15	+.07	30.17	30.49	11 29.60	40.89	53.1	-2.2	73.5	23 61.8	30.4	27	45.0	43.1	26.1	6	7.0	1477.8	45.9	4.38	-0.68	5.813	n.	29	ne.	12	8	7	7	17
<b>Western Gulf States.</b>																															
Shreveport	227	29.94	+.03	30.16	30.53	22 29.38	41.16	48.6	-0.6	73.2	4 58.7	25.4	27	39.0	47.8	33.4	3	9.1													



Table of miscellaneous meteorological data for December, 1885—Signal Service observations—Continued.

Stations.	Elevation above sea-level.	Atmospheric pressure (in inches and hundredths).				Temperature of the air (in degrees Fahrenheit).												Winds.																	
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes. Highest barometer.	Date.	Lowest barometer.	Date.	Monthly range of barometer.	Monthly mean.	Departure from normal.	Max.	Date.	Mean max.	Min.	Date.	Mean min.	Monthly range.	Greatest.	Least.	Date.	Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.							
																													Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.	
Upper Mississippi Valley																																			
Saint Paul.....	831	29.12	—0.03	30.09	30.65	25	29.39	4	1.26	21.1	+2.5	51.6	22	28.8	—7.9	7	13.2	69.5	33.3	6	3.3	27	81.4	16.0	0.64	—0.69	3,503	w.	25	nw.	4	6	7	15	9
La Crosse.....	725	29.24	—0.05	30.06	30.62	25	29.33	4	1.29	26.3	+3.8	53.0	22	33.3	—9.5	7	19.8	62.5	29.6	6	3.8	29	75.4	19.5	1.97	—0.69	6,313	n.	40	n.	4	10	11	12	8
Davenport.....	615	29.40	—0.04	30.10	30.63	25	29.32	4	1.30	25.6	+1.8	50.1	23	33.0	—6.9	14	18.2	57.0	25.8	18	4.5	31	79.0	19.7	1.95	—0.26	5,154	sw.	28	w.	4	13	7	17	7
Des Moines.....	849	29.16	—0.04	30.10	30.57	25	29.51	4	1.07	28.4	+4.8	55.9	22	35.7	—3.0	14	20.6	58.9	31.2	4	4.2	29	78.2	22.4	1.96	—0.42	3,700	n.	30	n.	11	11	10	15	6
Dubuque.....	665	29.33	—0.08	30.08	30.62	25	29.30	4	1.33	25.0	+0.4	51.5	23	32.3	—9.0	7	17.2	60.5	37.2	20	3.8	17	79.8	19.4	3.14	—1.34	3,169	n.	22	nw.	24	10	13	12	6
Keokuk.....	618	29.41	—0.03	30.11	30.60	25	29.37	4	1.23	28.7	+0.1	55.4	22	36.7	—5.2	14	19.9	60.6	34.3	15	4.6	28	79.8	22.9	1.96	—0.29	6,448	n.	38	n.	4	13	6	15	10
Calmar.....	359	29.76	—0.02	30.14	30.62	25	29.40	4	1.22	39.0	+0.8	62.7	23	45.6	—14.4	7	30.4	48.3	39.3	8	3.6	26	65.8	27.5	3.01	—0.72	6,674	n.	40	w.	9	8	7	14	10
Springfield.....	644	29.39	—0.04	30.09	30.60	25	29.35	4	1.24	35.6	+3.9	58.0	21	44.9	—6.0	14	28.1	52.8	32.7	15	7.8	16	9.9	26.5	2.52	—0.86	7,335	n.	34	n.	4	10	9	15	7
Saint Louis.....	571	29.50	—0.02	30.13	30.60	25	29.30	4	1.24	38.9	+4.7	64.9	29	47.8	—6.0	14	30.3	58.9	29.8	15	5.1	28	69.4	29.2	2.03	—0.42	9,955	n.	60	n.	4	9	8	12	11
Missouri Valley.																																			
Lamar.....	1,028	29.03	—0.05	30.16	30.54	25	29.40	8	1.14	36.3	+2.6	63.6	23	46.1	—4.3	14	26.4	67.9	38.2	4	6.9	12	72.0	26.8	0.91	—0.75	8,290	n.	48	n.	4	8	7	12	12
Leavenworth.....	842	29.21	—0.02	30.16	30.56	25	29.58	6	0.98	32.8	+2.6	60.2	22	41.2	—2.0	11	24.3	55.2	28.0	4	7.5	12	75.0	25.5	0.97	—0.75	4,383	n.	38	n.	4	6	7	15	9
Omaha.....	1,113	28.01	—0.03	30.16	30.60	29	29.62	3	0.99	28.6	+4.0	60.2	22	37.3	—4.4	13	20.6	64.4	30.8	2	4.6	7	80.7	23.2	1.17	+0.17	6,030	n.	50	n.	4	6	6	15	10
Valentine.....	2,603	27.28	—0.03	30.16	30.58	29	29.67	7	0.91	28.8	+4.0	60.2	22	45.2	—9.5	12	16.9	77.2	51.3	14	12.5	6	67.3	18.1	0.15	—0.15	8,999	n.	72	n.	4	3	7	20	4
Fort Sully.....	2,730	28.30	—0.03	30.16	30.58	29	29.67	9	0.95	26.5	+5.8	53.4	24	46.5	—8.4	12	15.2	69.4	50.1	14	13.4	6	68.0	20.9	0.14	—0.36	5,884	n.	58	n.	4	7	6	21	4
Huron.....	1,307	28.62	—0.05	30.16	30.64	29	29.54	3	1.10	23.6	+5.8	53.4	24	34.4	—11.1	12	15.0	64.4	44.5	4	7.4	16	68.8	5.14	0.10	—0.28	5,884	n.	39	n.	4	2	7	13	11
Yankton.....	1,228	28.73	—0.07	30.16	30.62	29	29.60	3	1.02	27.2	+6.8	58.8	20	37.0	—10.1	12	17.6	68.9	40.4	14	6.6	8	84.0	22.8	0.07	—0.69	5,477	n.	44	n.	4	2	4	18	9
Northern slope.																																			
Fort Assinaboine.....	2,720	27.10	—0.07	30.15	30.64	4	29.72	7	0.93	33.0	+16.1	67.9	22	43.8	—6.4	11	21.0	74.3	42.8	13	12.5	8	58.8	19.6	0.41	—0.39	10,134	sw.	48	sw.	1	2	9	15	7
Fort Benton.....	2,681	27.17	—0.07	30.15	30.64	4	29.78	25	0.87	35.6	+15.7	73.3	30	47.6	—0.9	11	24.8	72.4	42.0	27	5.8	8	69.5	26.0	0.38	—0.28	3,011	sw.	57	sw.	3	6	10	13	7
Fort Maginnis.....	4,340	25.46	—0.09	30.09	30.47	4	29.67	7	0.86	33.7	+13.6	64.8	21	41.7	—3.0	11	20.6	64.4	30.8	2	4.6	7	80.7	23.2	0.94	—0.19	11,074	w.	36	w.	2	10	11	16	4
Fort Shaw.....	3,550	26.30	—0.10	30.14	30.62	4	29.77	30	0.85	33.7	+13.6	64.8	21	45.2	—6.0	11	20.6	65.5	39.7	13	9.4	21	5.8	28.1	0.17	—0.77	10,170	w.	36	w.	3	4	3	23	5
Helena.....	4,044	25.81	—0.02	30.14	30.57	4	29.75	7	0.82	31.1	+10.7	56.8	25	39.3	—3.2	12	23.8	53.6	29.6	3	7.9	1	07.3	21.4	0.21	—1.41	4,524	sw.	36	sw.	3	9	5	19	7
Poplar River.....	2,030	27.82	—0.02	30.20	30.66	4	29.68	7	0.98	19.5	+11.8	58.2	22	41.7	—2.0	10	8.9	70.1	40.2	12	10.8	6	75.8	13.0	0.41	—0.13	4,524	sw.	36	sw.	3	9	5	19	7
Deadwood.....	4,600	25.2	+0.03	30.31	30.62	19	29.88	7	0.75	33.7	+11.8	58.2	22	41.7	—2.0	10	24.3	60.2	31.0	14	8.7	2	07.7	23.1	1.18	—0.37	1,661	sw.	30	sw.	20	11	5	10	16
Cheyenne.....	6,105	23.96	—0.03	30.25	30.57	2	29.75	7	0.82	33.0	+6.4	64.2	22	44.4	—11.8	11	21.7	76.0	39.9	4	9.7	9	04.7	21.7	0.16	—0.05	10,495	n.	52	n.	22	4	0	19	12
North Platte.....	2,841	27.09	—0.03	30.23	30.58	25	29.74	7	0.83	32.9	+7.8	69.0	22	44.3	—6.0	12	24.2	75.0	35.6	1	6.0	26	78.7	26.6	0.95	+0.20	3,682	w.	32	n.	4	5	7	10	14
Fort Laramie.....	5,000	25.46	—0.07	30.15	30.64	29	29.72	7	0.82	32.9	+7.8	69.0	22	44.3	—6.0	12	24.2	75.0	35.6	1	6.0	26	78.7	26.6	0.95	+0.20	3,682	w.	32	n.	4	5	7	10	14
Middle slope.																																			
Denver.....	5,294	24.74	+0.04	30.25	30.57	2	29.66	7	0.91	36.2	+6.0	74.1	22	48.7	—5.6	12	24.2	79.7	45.7	14	8.7	31	57.1	19.8	1.08	+0.37	6,048	n.	48	w.	22	5	3	12	16
Pike's Peak.....	14,134	17.68	—0.03	30.33	30.80	2	29.88	8	0.92	38.8	+2.7	76.4	22	46.3	—10.6	12	20.4	80.6	27.8	14	1.5	19	83.8	4.8	4.03	+2.77	19,905	n.	90	w.	22	9	3	16	12
West Las Animas.....	3,899	25.07	+0.06	30.20	30.51	24	29.64	7	0.97	33.3	+6.4	70.4	23	48.9	—5.8	12	21.0	82.2	49.7	3	6.8	11	70.5	25.4	0.91	+0.08	4,630	w.	34	n.	4	6	5	12	14
Concordia.....	1,384	28.59	—0.03	30.13	30.46	11	29.67	8	0.79	33.4	+6.4	70.4	23	43.4	—0.3	11	23.7	67.7	38.5	2	6.6	26	88.0	1.2	0.43	—0.08	6,318	n.	48	n.	4	10	7	12	14
Dodge City.....	2,517	27.44	—0.01	30.20	30.50	18	29.61	7	0.88	36.6	+6.0	70.0	22	40.9	—1.5	13	27.3	64.5	36.4	2	4.7	27	76.0	28.7	1.76	+1.04	7,240	n.	48	n.	4	7	5	10	16
Fort Reno.....	2,710	27.33	—0.01	30.20	30.50	18	29.61	7	0.88	36.6	+6.0	70.0	22	40.9	—1.5	13	27.3	64.5	36.4	2	4.7	27	76.0	28.7	1.76	+1.04	7,240	n.	48	n.	4	7	5	10	16
Fort Supply.....	2,710	27.33	—0.01	30.20	30.50	18	29.61	7	0.88	36.6	+6.0	70.0	22	40.9	—1.5	13	27.3	64.5	36.4	2	4.7	27	76.0	28.7	1.76	+1.04	7,240	n.	48	n.	4	7	5	10	16
Fort Elliott.....	2,650	27.48	—0.00	30.22	30.51	4	29.51	7	1.00	39.8	+6.0	77.5	23	52.2	—0.3	13	28.2	77.8	40.2	3	6.0	28	75.1	31.1	2.11	+1.26	8,307	n.	64	n.	4	9	7	10	14
Southern slope.																																			
Fort Sill.....	1,200	28.85	—0.02	30.15	30.44	5	29.42	7	1.03	43.4	+5.0	70.5	23	55.1	—15.3	13	34.1	55.2	31.5	17	6.6	21	76.0	35.1	1.58	—0.62	7,870	sw.	53	n.	4	5	6	7	18
Arlington.....	1,745	28.30	—0.02	30.20	30.50	14	29.54	7	0.97	49.4	+5.0	80.0	23	62.4	—14.8	13	38.6	65.2	24.1	7	6.8	24	70.0	38.9	0.98	—0.08	7,033								

*North Carolina.*—Charlotte, Fort Macon, Raleigh, and Statesville, 9th.

*Ohio.*—Jacksonborough, 8th.

*Oregon.*—Bandon, 4th, 25th.

*South Carolina.*—Stateburg, 2d, 9th; Pacolet and Spartanburg, 9th.

*Tennessee.*—Memphis, 8th; Nashville, 8th, 9th.

*Texas.*—Fort Elliott, 2d, 11th, 30th; New Ulm, Brownsville, and San Antonio, 12th; El Paso, 27th; Galveston, 29th.

*Washington Territory.*—Spokane Falls, 3d; Neah Bay, 17th.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos were observed in the various states and territories, as follows:

*Arkansas.*—19th, 20th.

*California.*—3d, 7th, 15th, 16th, 24th.

*Colorado.*—4th, 27th.

*Dakota.*—4th, 8th, 11th, 21st.

*Florida.*—20th, 21st, 22d, 28th.

*Georgia.*—6th, 17th, 28th.

*Illinois.*—2d, 3d, 5th, 7th, 22d, 26th, 27th.

*Indiana.*—18th.

*Iowa.*—2d, 6th, 7th, 9th, 13th, 24th.

*Kansas.*—7th, 9th, 19th, 24th, 31st.

*Louisiana.*—9th, 12th, 20th.

*Maine.*—1st.

*Massachusetts.*—4th.

*Michigan.*—8th, 12th, 13th, 20th, 21st, 26th.

*Minnesota.*—4th, 16th, 21st.

*Missouri.*—19th, 20th.

*Nebraska.*—19th to 24th.

*New Jersey.*—30th.

*New York.*—8th, 16th, 21st.

*Ohio.*—2d, 4th, 12th, 16th, 18th, 27th.

*Oregon.*—10th, 13th.

*Pennsylvania.*—17th.

*South Carolina.*—4th, 17th.

*Texas.*—10th.

*Vermont.*—8th.

*Virginia.*—4th, 10th, 17th, 23d, 30th.

*Washington Territory.*—30th, 31st.

*Wisconsin.*—2d, 3d, 7th, 10th, 14th, 21st.

*Wyoming.*—4th, 16th, 18th, 19th, 24th, 29th, 30th.

##### LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

*Alabama.*—17th, 19th, 20th, 22d.

*Arizona.*—15th to 18th, 20th, 21st, 22d, 25th.

*Arkansas.*—16th, 19th, 20th, 23d, 24th.

*California.*—15th, 16th, 17th, 19th, 20th, 24th, 30th.

*Colorado.*—11th, 16th, 18th, 22d.

*Connecticut.*—16th, 24th.

*Dakota.*—12th, 16th, 19th, 21st, 24th, 25th, 26th, 29th.

*Delaware.*—17th.

*Florida.*—1st, 17th to 22d, 24th.

*Georgia.*—17th to 21st.

*Illinois.*—5th, 11th, 15th, 19th, 20th, 22d, 28th.

*Indiana.*—9th, 15th, 17th, 19th to 22d.

*Iowa.*—15th, 23d, 24th.

*Kansas.*—2d, 12th, 15th, 17th to 24th, 26th.

*Kentucky.*—17th, 22d.

*Louisiana.*—15th, 17th, 19th, 20th, 25th.

*Maine.*—17th, 22d, 24th, 25th.

*Maryland.*—15th, 17th, 19th, 24th.

*Massachusetts.*—15th, 16th, 22d, 24th.

*Michigan.*—14th, 16th, 18th to 22d.

*Minnesota.*—12th, 16th, 17th, 19th, 20th, 21st, 27th.

*Missouri.*—19th, 20th, 23d, 26th.

*Montana.*—14th, 16th, 20th, 21st.

*Nebraska.*—12th, 16th, 19th, 21st to 24th.

*Nevada.*—18th, 20th, 22d, 24th.

*New Jersey.*—12th, 17th to 20th, 22d, 24th.

*New Mexico.*—25th.

*New York.*—15th to 18th, 20th, 21st, 24th to 28th.

*North Carolina.*—17th.

*Ohio.*—12th, 15th to 18th, 20th to 23d, 27th.

*Oregon.*—8th, 12th to 15th, 18th, 19th, 21st.

*Pennsylvania.*—12th, 15th, 16th, 17th, 20th, 21st, 24th, 25th.

*Rhode Island.*—24th.

*South Carolina.*—17th, 19th, 21st, 23d.

*Tennessee.*—17th, 18th, 19th, 21st, 22d, 23d, 28th.

*Texas.*—9th, 10th, 15th to 21st, 23d to 26th.

*Utah.*—18th, 21st, 24th.

*Virginia.*—17th, 21st, 23d, 24th, 27th.

*Washington Territory.*—14th, 15th, 20th, 27th.

*West Virginia.*—12th.

*Wisconsin.*—14th, 15th, 16th, 20th.

*Wyoming.*—14th, 17th, 18th, 19th, 21st, 24th.

The phases of the moon during December were: new moon, 6th, 8.10 a. m.; first quarter, 14th, 1.16 p. m.; full moon, 21st, 3.52 p. m.; last quarter, 28th, 7.16 a. m.; apogee, 10th, 4.30 p. m.; perigee, 22d, 8.12 p. m.

#### MIRAGE.

Sherlock, Finney county, Kansas: on the mornings of the 17th and 18th Garden City, about five miles distant from this place, and ordinarily invisible, being backed by a range of bluffs, was so plainly brought into view that the town seemed but a mile distant; the whole of each building was plainly seen.

Mirage was also observed at the following places:

Vermillion, Dakota, 15th.

Webster, Dakota, 19th, 21st.

Salina, Kansas, 22d, 24th.

Blue Hill, Massachusetts, 29th.

Marquette, Nebraska, 10th, 11th, 14th, 18th, 19th, 20th.

Harvard, Nebraska, 19th.

Cedar Keys, Florida, 23d, 27th, 28th.

Galveston, Texas, 13th, 14th.

Indianola, Texas, 9th, 18th, 19th.

Saint Vincent, Minnesota, 8th.

Duluth, Minnesota, 15th.

Sherburne, Minnesota, 19th.

#### MISCELLANEOUS PHENOMENA.

##### SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for December, 1885:

Date— December, 1885.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
2, 3 p. m.							1	15 <sup>1</sup>	
3, 1 p. m.	0	0	0	5 <sup>1</sup>	0	0	1	10 <sup>1</sup>	
6, 11 a. m.	0	0			0	0	0	0	
7, 11 a. m.	0	0	0	0	0	0	0	0	
8, 10 a. m.	2	4	0	0	0	0	2	4	
11, 9 a. m.	2	7 <sup>1</sup>					3	10 <sup>1</sup>	
12, 3 p. m.	0	0	0	0	0	0	2	5	
15, 10 a. m.							2	15 <sup>1</sup>	
17, 4 p. m.	0	0	0	0	0	0	2	10 <sup>1</sup>	
20, 10 a. m.	1	2	0	0			4	12 <sup>1</sup>	
22, 1 p. m.	0	0	0	0	0	0	3	10 <sup>1</sup>	
24, 11 a. m.	4	20 <sup>1</sup>					7	30 <sup>1</sup>	
25, 4 p. m.	0	0	1	3	0	0	5	20 <sup>1</sup>	
29, 1 p. m.							3	50 <sup>1</sup>	
30, 4 p. m.	0	0	0	0	0	0	3	40 <sup>1</sup>	Spots mostly small. Do.

Faculae were seen at the time of every observation.

<sup>1</sup> Approximated.

Mr. H. D. Govey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 4th, 7th, 14th, 16th, 18th, 21st, 25th, 26th.

#### SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,923 observations to have been made, of which three were reported doubtful; of the remainder,



4,920, there were 4,335, or 88.1 per cent., followed by the expected weather.

Concerning an unusual phenomenon which was observed in the western sky on the afternoon of the 15th at Hollidaysburg, Pennsylvania, and at several other places in that state, the following description, from the Altoona "Times," is given:

Just as the sun was setting below the western horizon a magnificent and vivid rainbow was seen spanning the heavens, the sun shining brightly beneath the centre of the bow. There were only a few persons who beheld this wonderful sight of a rainbow in mid-winter. They say they never in their lives before saw such a phenomenon.

The following correspondence, relative to the above-mentioned phenomenon, is from the "Johnstown (Pennsylvania) Weekly Tribune," of December 25th.

SIR: I noticed an account in your columns of the remarkable phenomenon that appeared above the western horizon recently, and that you seem to hold the Hollidaysburg correspondent of the Altoona "Times" in doubt as to the truth of the matter. Now, I would say that I witnessed the same wonderful sight from this place, and that it was one of the most striking scenes I ever beheld. It appeared just as a rainbow appears, with the sun shining beneath its centre. I have no doubt that many saw the same phenomenon, and that it can be vouched for by hundreds of others.

W. A. McVICKER.

STOYESTOWN, PENNSYLVANIA, December 20, 1885.

#### EARTHQUAKES.

Port Angeles, Washington Territory: a slight earthquake shock was felt about 1.40 a. m. of the 9th.

Tatoosh Island, Washington Territory: a distinct shock of earthquake was felt at 12.30 a. m. of the 18th, lasting about five seconds; it was followed by a second shock about ten minutes later.

Bloomington, McLean county, Illinois: a loud explosion, accompanied by a low, rumbling sound, supposed to have been due to an earthquake, was heard at 7.05 p. m. of the 26th, continuing at intervals for about fifteen minutes.

Santa Cruz, Santa Cruz county, California: two heavy shocks of earthquake were felt between 3 and 4 a. m. of the 28th; the vibrations were north and south.

San Francisco, California: at 9.46 a. m. of the 30th there was a slight shock of earthquake, followed about five seconds later by one of the most severe shocks that has visited this city since 1868; it lasted about ten seconds; vibrations from north to south.

Alcatraz Island and Fort Mason, California: two shocks of earthquake were felt at 9.45 a. m. of the 30th.

Oakland, California: a severe shock of earthquake, lasting about six seconds, with vibrations from east to west, and attended by a peculiar rumbling noise, was felt at 9.50 a. m. of the 30th; the motion induced by the vibrations seemed to be a lifting and gyratory one to the right.

San Rafael, Marin county, California: a severe earthquake shock was felt at 9.45 a. m. of the 30th. Houses were seen to rock to and fro and trees to bend. A loud noise accompanied the shock.

Benicia Barracks, California: a sharp earthquake shock was felt at 9.50 a. m. of the 30th.

The San Francisco "Alta," of December 31st, contains the following notes in reference to the earthquake of the 30th:

VALLEJO JUNCTION, December 30th.—There was a very perceptible earthquake shock at Vallejo Junction and Port Costa at 9.46½ o'clock this morning.

NAPA, December 30th.—Two sharp shocks of earthquake were felt here at 9.45 a. m.

REDWOOD CITY, December 30th.—A severe shock of earthquake was felt in this town this forenoon at 9.40 o'clock. The vibrations were north and south.

Petaluma, December 30th.—Quite a severe shock of earthquake was felt in this city at 9.47 o'clock a. m. The vibrations were north and south.

SAN MATEO, December 30th.—A severe shock of earthquake was felt here this morning about 9.45.

The following is an extract from the Galveston (Texas) "Daily News" of December, 5, 1885:

ALGHIERS, December, 4.—An earthquake has thrown down many houses at Mascara, Blidah, and Medeah, and destroyed three-quarters of the town of Msila. Thirty-two persons were killed and twelve others injured. Among the victims were several Europeans.

The following reports of earthquakes are furnished by Prof. C. G. Rockwood, jr., of Princeton, New Jersey.

Several shocks of earthquake occurred in Valparaiso, Arica, Tacna, and Serena, Chili, but the most alarming was at Iquique; the first shock occurred at 2.04 a. m. of the 11th; buildings were shaken in an ominous manner; five minutes after the first earthquake, a slight shock occurred, and ten minutes after the second a third was felt; the third was followed later on by two slight but distinct shocks. The sea was extraordinarily agitated, which continued, with gradually decreasing violence, throughout the 12th.

At Amatitlan, Guatemala, Central America, slight, but frequent, shocks of earthquake occurred on the 18th, which continued all day until 5.22 p. m., when a heavy shock was felt. At 5.36 p. m. the heaviest shock came, throwing down many walls and houses already fissured by the earlier shocks; people were thrown down, and the air was filled with dust from the fallen houses. One hundred and thirty-one shocks were felt the first day, principally from east to west, eighty-one of which occurred between 4 and 5.36 p. m.; the second day was nearly as bad, and the shocks continued for some days subsequently.

Vienna, Austria: a shock of earthquake was felt on the 30th, lasting seven seconds; no damage was done.

#### FOREST AND PRAIRIE FIRES.

Burrton, Harvey county, Kansas: a prairie fire occurred seven miles north of this place on the 4th, burning over an area of thirty miles, destroying 1,000 stacks of hay and grain, and killing a large number of live stock. Reports from Silver Lake township, Harvey county, state that the damage to property by the prairie fire of the 4th was very great; in Edwards county a dairyman was fatally burned.

Winfield, Cowley county, Kansas: extensive prairie fires occurred on the 4th; the Pattee Ranch, thirty miles south of this place, in Indian Territory, was entirely destroyed, together with four hundred to six hundred head of cattle.

Little Rock, Arkansas, 2d: extensive forest fires have been burning for several days south of this place, entailing great destruction of property.

Forest and prairie fires were also reported from the following stations:

Archer, Florida, 28th, 29th, 30th.

Limona, Florida, 9th.

Sherlock, Kansas, 2d, 3d.

North Platte, Nebraska, 3d.

Stateburg, South Carolina, 26th.

Midland, Texas, 10th.

Mobile, Alabama, 20th.

Fort Reno, Indian Territory, 3d, 4th, 6th, 31st.

Fort Supply, Indian Territory, 3d.

Yankton, Dakota, 3d.

#### METEORS.

Elk Falls, Elk county, Kansas: a brilliant meteor was observed in the north at 9 p. m. of the 1st.

Somerset, Bristol county, Massachusetts: a number of meteors were observed during the evening of the 3d.

Prairie du Chien, Crawford county, Wisconsin: a large number of shooting stars were observed during the early morning of the 6th.

Duluth, Minnesota: a meteor of an intense pale green color was observed about 8 p. m. of the 7th; it fell rapidly towards the horizon, without noise, and burst into several fragments.

The following is from the New York "Journal of Commerce" of January 8, 1886:

Schooner "J. C. Ford," at Kahului, Sandwich Islands, December 17th, from San Francisco, reports, December 12th, latitude 22° N., longitude 148° W., weather fine, was struck by a meteor, which set fire to the mainmast-head and burned the staysails; other sails were set on fire, but were soon cut away and thrown overboard.

Nicolaus, Sutter county, California: a brilliant meteor was observed at 8.45 p. m. of the 10th in the east-southeastern sky; it moved slowly in a southerly direction along a nearly horizontal path of 20° altitude; it burst like a bomb, emitting beautiful colored rays.

Voluntown, New London county, Connecticut: two meteors were observed during the evening of the 11th, one of which moved in a direct line from north to south, leaving a bright trail.

Washington, District of Columbia: the fragments of a bril-

liant meteor were observed to fall in the southwest quarter of the sky at 5.15 a. m. of the 11th. It lighted up the city momentarily, causing a very distinct shadow.

Westerville, Franklin county, Ohio: seven very bright meteors were observed from 10 to 10.15 p. m. of the 11th, radiating from a point in Gemini.

Dubuque, Iowa: a large and brilliant meteor was observed at 5 a. m. of the 18th, moving across the sky in a southeasterly direction, leaving a large trail of fire.

Cedar Rapids, Linn county, Iowa: small meteors were observed nearly every clear evening during the month.

Meteors were also reported from the following stations, the observers giving dates only:

*Arkansas.*—Lead Hill, 4th, 10th, 23d.  
*California.*—Los Angeles, 27th.  
*Connecticut.*—Voluntown, 12th; Bethel, 7th, 19th.  
*Dakota.*—Vermillion, 1st; Webster, 11th.  
*Florida.*—Limona, 8th, 9th, 10th; Manatee, 11th.  
*Illinois.*—Anna, 3d; Bloomington, 6th; Cairo, 2d.  
*Indiana.*—Vevay, 11th.  
*Iowa.*—Monticello, 4th, 12th, 18th, 23d.  
*Kansas.*—Manhattan, 1st.  
*Maryland.*—Woodstock, 2d, 12th, 16th, 24th; Baltimore, 10th.  
*Minnesota.*—Moorhead, 11th.  
*New York.*—Menand Station, 12th.  
*Ohio.*—Wauseon, 1st, 3d.  
*Pennsylvania.*—Quakertown, 12th.  
*Texas.*—Cleburne, 1st, 7th.  
*Vermont.*—Strafford and Stowe, 25th.  
*Virginia.*—Variety Mills, 19th; Dale Enterprise, 3d; Fort Myer, 21st.

#### MIGRATION OF BIRDS.

*Geese flying southward.*—Little Rock, Arkansas, 6th; Lewiston, Idaho, 11th; Cairo, Illinois, 5th; Fort Madison, Iowa, 27th; Yates Centre, Kansas, 1st; Liberty Hill, Louisiana, 3d; Grand Haven, Michigan, 29th; Little Egg Harbor, New Jersey, 25th, 27th; Santa Fé, New Mexico, 27th; Ashwood, Tennessee, 28th, 30th; Brownsville, Texas, 10th; Tatoosh Island, Washington Territory, 3d, 9th.

*Geese flying northward.*—Yuma, Arizona, 19th; Charleston, Illinois, 21st; Wellington, Kansas, 21st; Yates Centre, Kansas, 22d; Fort Scott, Kansas, 9th; Indianola, Texas, 24th, 25th, 28th.

*Geese flying eastward.*—Fort Madison, Iowa, 31st; Abilene, Texas, 6th.

*Geese flying westward.*—Yuma, Arizona, 21st; Charleston, Illinois, 23d; Yates Centre, Kansas, 24th.

*Ducks flying southward.*—Wickenburg, Arizona, 8th; Charleston, Illinois, 5th; Yates Centre, Kansas, 3d; Knoxville, Tennessee, 4th, 6th, 25th, 28th.

*Ducks flying northward.*—Charleston, Illinois, 2d, 21st; Indianola, Texas, 24th, 25th, 28th.

*Brants flying northward.*—Charleston, Illinois, 24th.

#### POLAR BANDS.

Milwaukee, Wisconsin: the entire sky was covered with polar bands from 8 to 9.15 p. m. of the 20th; they apparently radiated from a common centre near the northwest horizon and spread out to the southward in a fan-like formation; the bands were numerous, very narrow, but well defined.

Polar bands were also reported from the following places:

*Arkansas.*—Lead Hill, 25th.  
*Colorado.*—West Las Animas, 21st; Montrose, 16th.  
*Florida.*—Archer, 5th, 8th, 21st, 22d, 28th; Key West, 15th.  
*Illinois.*—Riley, 3d, 15th, 20th, 27th.  
*Indiana.*—Indianapolis, 26th.  
*Iowa.*—Manchester, 24th.  
*Kansas.*—Ninnescah, 5th.  
*Maine.*—Gardiner, 4th.  
*Massachusetts.*—Amherst, 29th.  
*Michigan.*—Escanaba, 21st.

*Missouri.*—Centreville, 19th.

*New Jersey.*—Beverly, 22d, 25th.

*New York.*—New York City, 27th.

*Ohio.*—Wauseon, 7th, 16th, 17th, 22d, 23d, 27th; Cincinnati, 22d.

*South Carolina.*—Stateburg, 24th.

*Tennessee.*—Nashville, 3d, 4th, 18th, 25th.

*Virginia.*—Wytheville, 7th, 21st, 27th.

*Washington Territory.*—Bainbridge Island, 1st; Tatoosh Island, 3d.

*Wisconsin.*—Prairie du Chien, 25th.

#### SAND STORMS.

Yuma, Arizona, 7th.

Fort Union and Santa Fé, New Mexico, 7th.

Cleburne, Texas, 4th.

#### WATER-SPOUTS.

The Norwegian s. s. "Stamford," Captain Gjemre, on the 24th, when about seventy miles east of Cape Hatteras, North Carolina, saw a water-spout.

#### ERRATA.

On page 267 of the REVIEW for October, 1885, in the table of voluntary observers, the minimum temperature, Sacramento, California, given as 30°, should read 37°.

On page 281 of the REVIEW for November, 1885, table "Temperature of water," the temperature given under the heading "Mean temperature of the air at station," is that observed at the time of the water temperature observation. The mean temperature can be obtained from the tables of miscellaneous data.

*Meteorological record of voluntary observers and Army post surgeons, December, 1885.*

The maximum and minimum temperatures at stations marked thus (\*) are from readings of other than standard instruments.

Stations.	Temperature.			Rainfall.		Stations.	Temperature.			Rainfall.
	Maximum.	Minimum.	Mean.				Maximum.	Minimum.	Mean.	
<i>Alabama.</i>	0	0	0	Inches		<i>Dakota—Continued.</i>	0	0	0	Inches
Birmingham *	63	20	47.5	3.40		Vermillion	58	14	27.0	0.35
Greensborough	69	27	47.5	5.33		Webster *	56	12	23.2	0.63
Mount Vernon B'ks.	72	27	50.5	2.77		Yates, Fort	56	15	23.1	0.28
<i>Arizona.</i>						<i>District of Columbia.</i>				
McDowell, Fort	83	30	52.8	0.87		Distributing Res'r *	63	17	38.0	1.61
Tucson				1.01		Receiving Res'r *	62	14	36.8	2.48
<i>Arkansas.</i>						Rock Creek Bridge *	64	16	39.9	2.48
Lead Hill *	72	0	39.0	2.30		West Washington				2.48
Mount Ida *	70	15	42.0	3.30		<i>Florida.</i>				
<i>California.</i>						Archer	77	30	55.4	5.61
Alcatraz Island	66	44	55.4	3.47		Limona *	85	28	58.3	1.83
Angel Island	76	43	52.9	4.04		Manatee *	80	28	58.0	2.21
Benicia Barracks	63	43	50.6	5.86		Meade, Fort				0.75
Bidwell, Fort	60	15	37.8	3.12		Merritt's Island	76	38	58.0	1.27
Cahuenga Valley				1.65		Saint Augustine, Ft	74	28	52.5	4.36
College City *	64	34	48.9	3.55		Tallahassee *	72	26	56.7	1.60
Gaston, Fort	69	28	47.6	9.36		<i>Georgia.</i>				
Mason, Fort	64	43	55.1	5.94		Athens	65	20	42.5	2.86
Murieta *	80	27	49.5	0.74		Forsyth *	72	24	49.0	3.07
Nicolaus *	63	40	50.6	5.03		Milledgeville *	73	21	47.0	2.66
Oakland *	66	41	52.4	4.33		Quitman *	73	27	50.0	2.90
Oroville *	75	37	53.0	5.53		<i>Illinois.</i>				
Poway *	85	35	53.6	0.90		Anna	64	12	41.2	2.93
Presidio of San F	66	39	52.9	4.35		Bloomington	48	10	23.2	3.13
Princeton	60	33	49.0	4.78		Bunker Hill *	61	4	31.6	2.42
Sacramento *	67	34	50.0	5.33		Collinsville	58	4	28.9	1.55
Salinas *	74	32	52.0	1.30		Charleston *	56	4	30.0	3.34
San Rafael *	73	31	52.0	6.69		Geneseo	47	10	24.6	2.15
Susanville				4.23		Mattoon *	61	2	33.0	3.00
<i>Colorado.</i>						Peoria *	52	2	31.2	2.44
Braddock	48	32	40.0	3.58		Riley *	52	10	27.0	2.00
Lyon, Fort	75	6	34.5	0.73		Rockford *	42	12	23.2	2.37
Pueblo	70	2	34.7	0.73		Sandwich *	40	14	26.1	3.17
<i>Connecticut.</i>						South Evanston	46	13	25.4	2.24
Bethel	58	7	30.9	3.89		Sycamore *	42	10	23.9	3.05
Hartford	50	2	25.7	4.49		Windsor	56	10	30.8	3.80
North Colebrook *	57	6	31.0	3.43		<i>Indian Territory.</i>				
Southington	50	4	27.0	3.40		Reno, Fort	72	2	41.2	1.97
Voluntown *						<i>Indiana.</i>				
<i>Dakota.</i>						Fort Wayne *	57	2	33.0	2.66
Abr. Lincoln, Fort	57	11	22.7	0.50		Guilford *	54	0	31.9	1.75
Meade, Fort	59	2	33.3	0.17		Jeffersonville	59	6	36.2	2.43
Pembina, Fort	40	24	9.6	1.05		Laconia *	61	8	25.0	2.24
Randall, Fort	61	15	29.4	0.50		Lafayette	54	10	28.7	2.54
Richardson	59	10	24.2	0.75		LaGrange *	46	7	27.9	3.00
Sisseton, Fort	50	10	18.7	0.75		Logansport *	60	5	31.6	3.05
Sully, Fort	53	8	28.2	0.01		Mauzy				2.02
Totten, Fort	41	22	14.1	0.51						



## Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature.				Rainfall.	Stations.	Temperature.				Rainfall.
	Maximum.	Minimum.	Mean.				Maximum.	Minimum.	Mean.		
<i>Indiana—Continued.</i>	°	°	°		<i>Inches</i>	<i>Missouri—Contin'd.</i>	°	°	°		<i>Inches</i>
Spiceland.....	54	-3	30.8	2.36		Pierce City.....	65	-3	37.3	1.00	
Sumner.....	51	-2	31.9	2.22		Springfield.....	62	0	38.0	1.50	
Terre Haute.....	58	2	36.9	4.03		<i>Montana.</i>					
Vevay.....	62	7	36.9	2.62		Assinaboine, Fort.....	67	-18	31.5	0.08	
<i>Iowa.</i>						Ellis, Fort.....	58	-15	31.1	0.75	
Bancroft.....	53	-14	22.2	0.40		Keogh, Fort.....	59	-15	29.6	0.22	
Cedar Rapids.....	44	-10	22.1	1.48		Shaw, Fort.....	65	-1	30.2	0.17	
Cedar Rapids.....	46	-12	20.0	2.46		<i>Nebraska.</i>					
Cresco.....	46	-22	20.2	1.49		Crete.....	66	-9	28.4	0.71	
Des Moines.....	55	-10	25.9			De Soto.....	56	-7	27.1	1.73	
Guttenberg.....	48	-12	18.3	2.26		Fairbury.....	62	-7	26.3	1.07	
Humboldt.....	52	-10	23.6	0.96		Genoa.....	68	-4	29.5	0.65	
Independence.....	43	-10	23.2	1.80		Harvard.....	88	6		1.75	
Logan.....	45	0	25.6	1.40		Marquette.....				0.68	
Fort Madison.....	53	-9		1.80		Robinson, Fort.....	74	-13	33.7	0.05	
Manchester.....	50	-8	23.5	2.51		Stockham.....				1.85	
Monticello.....	46	-11	22.6	2.48		<i>Nevada.</i>					
Mount Vernon.....	48	-10	25.6			McDermitt, Fort.....	56	5	34.6	0.94	
Muscataine.....	47	-7	19.7	2.32		<i>New Hampshire.</i>					
Oakalona.....	51	-16	24.1	1.60		Antrim.....				4.35	
Oakalona.....	51	-16	24.1	1.60		Ashland.....				5.15	
West Union.....	46	-10	20.4	1.82		Belmont.....				4.46	
<i>Kansas.</i>						Bristol.....				4.49	
Atchison.....	58	1	31.5	1.10		Lake Village.....	59	6	25.8	2.58	
Elk Falls.....	47	5		1.00		Nashua.....				4.74	
Emporia.....	60	0		0.70		Wier Bridge.....				4.83	
Fort Scott.....	63	6	37.2			Woodstock.....				5.05	
Independence.....	65	1	36.3	0.95		<i>New Jersey.</i>					
Lawrence.....	57	2	32.5	1.25		Beverly.....	60	10	35.0	2.80	
Manhattan.....	58	-4	31.7	0.57		Clayton.....	60	9	35.6	2.65	
Manhattan.....	59	-3	35.7	0.55		Dover.....	57	6	32.4	4.10	
Ninnescah.....	64	3	35.7	0.72		Moorestown.....	60	7	34.6	3.07	
Salina.....	53	14	35.0	0.02		Patterson.....	54	17	33.5	3.28	
Sherlock.....	71	3	35.1	1.12		Phillipsburg.....	50	20	31.8	2.40	
Sterling.....	65	0	34.5	1.13		Princeton.....	59	10	34.2	2.54	
Wellington.....	60	-9	34.9	1.57		Readington.....	62	14	39.3	3.50	
W. Leavenworth.....	57	6		0.40		Somerville.....	54	10	33.9	2.47	
Westmoreland.....	58	-4	31.0	1.12		Vineland.....	60	10	35.2	3.48	
Wyandotte.....	56	-2	29.2	0.80		<i>New Mexico.</i>					
Yates Centre.....	60	-2	32.4	1.08		Gallinas Spring.....	57	19		1.00	
<i>Kentucky.</i>						Puerto de Luna.....	70	10	41.0	0.66	
Frankfort.....	60	8	36.4	2.69		Union, Fort.....	65	-9	35.6	1.42	
Richmond.....	60	6	35.8	2.55		Wingate, Fort.....	62	3	34.6	1.00	
<i>Louisiana.</i>						<i>New York.</i>					
Grand Coteau.....	73	28	54.4	2.70		Auburn.....	55	7	31.7	2.78	
Luling Hill.....	75	34	54.5	2.47		Columbus, Fort.....	59	14	35.5	2.50	
Luling.....	70	20	50.2	4.42		Cooperstown.....	54	4	27.5	2.15	
Morgan City.....	71	23	48.5	6.10		David's Island.....	56	11	33.4	3.30	
Point Pleasant.....	73	21	48.5	3.27		Humphrey.....	52	-4	29.4	1.26	
<i>Maine.</i>						Ithaca.....	46	5	25.2	3.31	
Bar Harbor.....	56	6		4.20		LeRoy.....	56	-1	28.8	3.23	
Buckfield.....	49	0	23.9	3.30		Madison Barracks.....	54	8	29.2	3.18	
Cornish.....	54	5	25.9	4.00		Menand Station.....	56	8	29.1	1.48	
Gardiner.....	50	0	21.5	2.41		Mountainville.....	59	7	32.1	2.59	
Kent's Hill.....	56	2	25.9	5.64		Niagara, Fort.....	52	7	30.1	1.45	
Orono.....	56	10	29.2	1.61		North Volney.....	53	7	27.7	3.65	
<i>Maryland.</i>						Palermo.....	47	5	25.6	3.93	
Cumberland.....	58	8	35.4	1.55		Palmyra.....	47	5	31.6		
Fallston.....	65	11	34.8	2.64		Penn Yan.....				1.35	
Great Falls.....	60	12	35.3	2.16		Plattsburg B'ks.....	51	14	35.8	4.09	
McDonogh.....	60	8	34.2	1.36		Setauket.....	59	14	35.8	4.09	
McHenry, Fort.....	62	15	38.4	2.50		West Point.....	57	5	32.9	4.60	
Woodstock.....	60	6	34.8	3.02		White Plains.....	55	7	38.4	4.50	
<i>Massachusetts.</i>						<i>North Carolina.</i>					
Amherst.....	55	8	30.4	3.90		Lenoir.....	64	13		3.20	
Amherst.....	65	6	29.6	3.54		Lincolnton.....	58	17	38.2	3.43	
Blue Hill Obs'y.....	56	7	29.7			Reidsville.....	72	26	44.0	3.90	
Deerfield.....	59	-5	28.3	3.07		Reidsville.....	80	22		0.18	
Dudley.....	57	-1	29.1	2.72		Statesville.....	62	24	42.1	3.02	
Fall River.....	58	11	33.4	3.56		Wake Forest.....	60	20	43.1	3.84	
Leicester.....	57	4	27.5	3.96		Weldon.....	68	22	42.4	3.30	
Mendon.....	56	10	29.3	2.00		<i>Ohio.</i>					
Milton.....	61	10	32.0			Cleveland.....	62	3	32.7	1.59	
New Bedford.....	51	9	32.9	3.22		Clyde.....	55	-2		5.04	
Princeton.....	56	4	27.0	1.91		College Hill.....	49	2	35.0	1.60	
Somerset.....	67	7	33.0	2.60		Fosteria.....	53	-4	29.3		
Taunton.....	61	9	33.3	2.49		Garrettsville.....	61	-13	29.4	1.78	
Worcester.....	58	7	29.9	3.09		Hiram.....	59	1	28.9	2.02	
Williamstown.....	59	5	25.0	3.43		Jacksonborough.....	58	-5	31.1	1.90	
Westborough.....	64	9	32.7	3.07		McConnellsville.....	69	-2	33.4	1.75	
<i>Michigan.</i>						Napoleon.....	52	-4	31.4	2.10	
Birmingham.....	48	-7		2.62		North Lewisburg.....	55	-3	31.7	1.55	
Brady, Fort.....	42	-15	22.1	4.72		Portsmouth.....	66	8	35.8	1.85	
Harrieville.....	48	-11		1.62		Ruggles.....	51	-2	31.2	1.35	
Hudson.....	47	-7		2.63		Tiffin.....	54	-2	30.0	1.89	
Kalamazoo.....	51	-3		2.63		Westerville.....	58	1	31.5	1.35	
Lansing.....	48	-6	27.1	2.80		Wauseon.....	54	-7	28.3	2.57	
Manistiquette.....	46	-8	25.7	3.20		West Milton.....	59	0	27.0	2.25	
Mottville.....	46	4		3.00		Yellow Springs.....	56	0	33.3	1.59	
Pentwater.....	52	6	28.2	3.58		<i>Oregon.</i>					
Swartz Creek.....	50	-6	27.7	3.42		Albany.....	60	30	44.6	7.04	
Traverse City.....	43	2		4.94		Bandon.....	60	32	45.9	13.27	
<i>Minnesota.</i>						East Portland.....	54	22		4.13	
Minneapolis.....	43	-15	20.5	0.89		Eola.....	53	27	43.9	7.41	
Northfield.....	51	-10	22.0	0.69		Klamath, Fort.....	52	14	34.8	3.66	
Snelling, Fort.....	53	-21	21.3	0.48		<i>Pennsylvania.</i>					
<i>Missouri.</i>						Altoona.....	55	3	25.6	1.73	
Carthage.....	64	-3	38.4	1.64		Blooming Grove.....	54	-1	31.1	2.10	
Centerville.....	64	-5		2.85		Catawissa.....	56	5	30.2	2.33	
Conception.....	56	-7	29.5	1.30							
Frankford.....	70	-9		2.23							

## Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature.				Rainfall.	Stations.	Temperature.				Rainfall.
	Maximum.	Minimum.	Mean.				Maximum.	Minimum.	Mean.		
<i>Pennsylvania—Con.</i>					<i>Inches</i>	<i>Vermont—Continued</i>					<i>Inches</i>
Chambersburg.....	60	10	34.5	1.05		Charlotte.....	50	0	24.5	2.20	
Drifton.....	56	-4	28.1	2.82		Dorset.....	61	0	26.0	3.03	
Dyberry.....	48	-10	27.7	2.23		Lunenburg.....	52	-4	23.0	1.70	
Easton.....	58	10	34.4	3.30		Newport.....	48	-10	20.4	2.88	
Fallingtown.....	55	-1	26.2	2.58		Post Mills Village.....	44	-14	19.5		
Franklin.....	55	11	33.3	3.33		Stratford.....	50	0	22.5	3.60	
Germantown.....	50	8	24.2	2.72		Poultney.....	61	-2	26.0	3.47	
Grampian Hills.....	52	9	33.9	4.17		<i>Virginia.</i>					
Mahanoy Plane.....	52	9	30.7	3.07		Accotink.....	66	13	38.6	1.96	
Quakertown.....	48	8	31.2	3.15		Bird's Nest.....	67	20	42.0	3.15	
Quakertown b.....	49	-1	28.3	1.20		Brunting.....	62	9	39.5	4.09	
Troy.....	48	2	31.3	5.89		Dale Enterprise.....	68	10	35.0	2.60	
Wellsborough.....	57	9	33.7	4.18		Marion.....	65	21	42.2	3.08	
West Chester.....	56	5	32.3	2.68		Monroe, Fort.....	62	22			
Wilkesbarre.....	56	0	26.5	1.91		Snowville.....	62	9	35.5		
Wysox.....	56	0				Summit.....	60	11	37.6	2.85	
<i>South Carolina.</i>						Variety Mills.....	60	14	37.6	2.85	
Aiken.....	73	24	46.0	2.78		Wytheville.....	65	14	30.1	3.02	
Kirkwood.....	58	18	38.9	3.29		<i>Washington Territory.</i>					
Pacolet.....	65	22	40.7	3.06		Bainbridge Island.....	60	24	43.5	6.22	
Spartanburg.....	70	0	25.0	2.60		Kenewick.....	56	10	37.0	1.03	
Stateburg.....	66	24	45.9	2.42		Pleasant Grove.....	55	6		1.55	
<i>Tennessee.</i>						Tacoma.....	60	28	41.4	6.13	
Ashwood.....	63	17	39.5	2.77		Townsend, Fort.....	60	25	45.3	1.70	
Milan.....	65	17	39.7	2.91		<i>West Virginia.</i>					
<i>Texas.</i>						Helvetia.....	70	0	34.4	3.19	
Austin.....	79	29	53.9	2.69		Parkersburg.....	71	-1	34.8	0.10	
Cleburne.....	84	16	40.1	1.56		<i>Wisconsin.</i>					
Comfort.....	81	15	51.3	0.70		Embarras.....	45	-22	22.8	3.75	
Concho, Fort.....	81	15	51.3	0.70		Madison.....	51	-13	23.7	3.59	
Corsicana.....	79	25	52.5	3.26		Manitowoc.....	46	-15	20.5	3.24	
Huntsville.....	79	25	52.5	3.8		Neillville.....	36	-31	11.2	1.35	
Midland.....	76	12	45.4	0.15		Wausau.....	48	-22	20.5	2.48	
New Ulm.....	82	26	54.4	3.79		<i>Wyoming.</i>					
<i>Vermont.</i>						Bridger.....	55	-3	25.8	trace.	
Brattleborough.....	54	4	28.6	2.75		Fred Steele, Fort.....	56	-20	28.0	0.22	
Burlington.....	56	-1	28.5	2.07							

## Annual mean temperature, etc.—Continued.

Stations.	Temperature.						Precipitation.		
	Normal.	Mean for 1885.	Departure.	Extremes for 1885.			Normal.	Total for 1885.	Departure.
				Maximum.	Date.	Minimum.			
<i>East Gulf states.</i>									
Atlanta	61.7	58.5	-3.1	91.2	July 30	8.0	Feb. 11	56.23 57.11	+0.88
Montgomery	65.6	63.0	-2.6	98.0	July 31	15.5	Feb. 11	53.25 58.89	+5.64
Pensacola	68.4	65.8	-2.6					68.56 64.57	-3.99
Mobile	67.1	64.2	-2.9	94.2	Aug. 8	19.9	Jan. 18	65.97 64.00	-1.97
Vicksburg	65.7	61.8	-3.9	98.7	July 31	17.2	Feb. 11	61.38 54.28	-7.10
New Orleans	69.3	67.4	-1.9	93.2	Aug. 7	27.7	Jan. 18	64.36 64.18	-0.18
<i>West Gulf states.</i>									
Fort Smith	59.5	58.1	-1.4	98.6	July 31	1.0	Feb. 10	48.64 31.61	-17.03
Little Rock	62.3	61.0	-1.3	100.0	July 31	9.6	Jan. 17	60.35 35.81	-24.54
Shreveport	65.6	63.9	-1.7	100.7	Aug. 1	13.0	Jan. 17	54.11 58.60	+4.49
Painting	65.0	63.6	-1.4	97.5	Aug. 10	11.1	Jan. 17	47.56 41.25	-6.31
Indianola	70.1	68.9	-1.2	96.3	July 28	31.3	Jan. 17	38.72 38.58	-0.14
Galveston	70.1	69.8	-0.3	94.5	July 19	23.4	Jan. 17	52.30 62.56	+10.26
San Antonio	69.0	69.5	+0.5	97.8	Aug. 4, 6, 7	25.8	Dec. 14	32.96 29.92	-3.04
<i>Rio Grande Valley.</i>									
Rio Grande City	73.4	72.5	-0.9	108.6	Aug. 6	24.2	Jan. 17	22.52 36.52	+4.00
Brownsville	73.8	71.1	-2.7	95.4	May 30	27.0	Jan. 17	33.01 31.83	-1.18
<i>Tennessee.</i>									
Nashville	59.7	56.5	-3.2	96.1	July 30	-2.3	Jan. 22	53.66 43.95	-10.71
Memphis	61.1	60.2	-0.9	98.5	Aug. 10	2.7	Jan. 22	56.10 37.41	-18.69
Chattanooga	60.4	57.7	-2.7	96.1	July 30	6.9	Feb. 11	56.84 50.01	-6.83
Knoxville	57.3	55.6	-1.7	94.0	July 30	1.0	Feb. 11	53.87 54.70	+0.83
<i>Ohio Valley.</i>									
Pittsburg	52.0	50.7	-1.3	99.0	July 21	-8.8	Feb. 11	36.87 34.12	-2.75
Columbus	52.7	48.8	-3.9	90.7	July 20	-11.0	Feb. 11	42.36 42.25	-0.11
Indianapolis	53.1	49.3	-3.8	95.1	Aug. 9	-11.3	Jan. 22	47.01 39.51	-7.50
Greencastle		48.8		92.4	July 20	-14.7	Jan. 22	50.11	
Cincinnati	55.9	51.0	-4.9	96.6	July 20	-9.6	Feb. 11, 21	43.74 33.94	-9.80
Louisville	56.8	55.5	-1.3	97.2	July 21	-5.0	Jan. 22	49.04 47.23	-1.81
<i>Lower lake region.</i>									
Detroit	48.2	46.9	-1.3	89.5	July 8	-11.6	Feb. 10	34.76 28.24	-6.52
Toledo	50.2	47.3	-2.9	93.2	July 21	-15.5	Feb. 11	32.74 33.19	+0.45
Sandusky	51.0	47.0	-4.0	90.0	June 7	-14.9	Feb. 11	40.42 34.23	-6.19
Cleveland	49.0	45.6	-3.4	90.1	July 17	-15.1	Feb. 11	38.03 39.93	+1.90
Erie	49.4	46.0	-3.4	89.8	July 6	-12.3	Feb. 11	42.67 52.13	+9.46
Buffalo	49.6	43.5	-6.1	87.4	July 6	-12.8	Feb. 11	37.06 52.36	+15.30
Rochester	46.9	43.7	-3.2	94.7	July 17	-11.0	Feb. 11	36.77 28.30	-8.47
Oswego	47.4	42.3	-5.1	89.6	July 17	-7.0	Feb. 11	35.70 33.14	-2.56
<i>Upper lake region.</i>									
Duluth	39.7	36.3	-3.4	92.7	July 30	-41.2	Jan. 2	34.01 20.14	-13.87
Marquette	41.0	36.4	-4.6	88.8	July 16	-25.3	Mar. 16	33.35 28.85	-4.50
Escanaba	40.4	37.6	-2.8	87.2	July 26	-26.1	Jan. 28	35.60 31.42	-4.18
Milwaukee	45.0	41.4	-3.6	92.8	July 28	-23.6	Feb. 11	33.63 33.77	+0.14
Chicago	48.7	46.4	-2.3	93.9	July 20	-13.7	Feb. 11	37.34 44.37	+7.03
Grand Haven	46.9	43.0	-3.9	85.7	July 22	-7.2	Feb. 21	39.85 35.81	-4.04
Mackinaw City	40.0	38.0	-2.0	86.0	July 8	-33.4	Feb. 6	40.32 28.48	-11.84
Alpena	41.2	37.8	-3.4	88.0	Sept. 26	-23.0	Feb. 6	37.58 34.71	-2.87
Port Huron	45.2	41.7	-3.5	89.9	June 20	-25.0	Feb. 11	34.65 33.81	-0.84
<i>Extreme northwest.</i>									
Fort Buford	38.3	39.9	+1.6	96.0	July 14	-45.5	Jan. 1	14.63 15.56	+0.93
Bismarck	39.4	39.4	0.0	97.4	July 29	-37.3	Jan. 1	21.47 13.09	-8.39
Moorhead	36.6	37.4	+0.8	92.0	Sept. 25	-34.9	Jan. 1	29.24 22.55	-6.69
Saint Vincent	33.2	33.4	+0.2	91.1	July 29	-46.0	Jan. 1	19.42 16.58	-2.84
<i>Upper Minn. valley.</i>									
Saint Paul	43.9	42.0	-1.9	94.7	July 30	-35.6	Jan. 2	29.54 25.33	-4.21
La Crosse	46.7	44.2	-2.5	92.0	July 20, 28	-25.0	Jan. 22	34.35 30.70	-3.65
Dubuque	48.1	44.8	-3.3	97.1	July 30	-22.5	Jan. 28	39.72 40.45	+0.73
Davenport	49.7	46.9	-2.8	97.4	July 30	-17.8	Jan. 28	36.13 34.35	-1.78
Des Moines	48.7	46.8	-1.9					42.45 35.03	-7.42
Keokuk	51.8	49.3	-2.5	99.0	July 30	-14.5	Feb. 10	38.13 35.11	-3.02
Springfield	53.0	50.8	-2.2	96.2	July 30	-13.7	Jan. 22	47.52 38.61	-8.91
Saint Louis	55.4	54.6	-0.8	96.6	July 30	-9.7	Jan. 22	37.80 45.59	+7.79
Cairo	58.1	56.1	-2.0	95.8	July 30	-4.0	Jan. 22	40.74 31.99	-14.75
<i>Missouri valley.</i>									
Fort Bennett	43.6	45.0	+1.4	102.1	July 26	-39.9	Jan. 1	17.85 19.55	+1.70
Yankton	45.6	44.8	-0.8	100.7	July 29	-24.0	Jan. 3	28.21 30.18	+1.97
Huron	41.8	41.6	-0.2	98.2	July 30	-33.0	Jan. 1	24.07 25.78	+1.71
Omaha	49.6	48.0	-1.6	98.8	July 28	-16.2	Feb. 10	30.45 36.68	+6.23
Leavenworth	53.3	51.1	-2.2	97.8	July 19	-18.4	Jan. 1	38.97 43.64	+4.67
<i>Northern slope.</i>									
Fort Assinaboine	40.3	45.3	+5.0	96.4	Aug. 14	-29.8	Jan. 1	17.84 6.82	-11.02
Fort Benton	42.6	46.6	+4.0	104.9	Aug. 14	-37.9	Jan. 19	12.50 14.94	+2.44
Fort Shaw	41.2	45.5	+4.3	96.2	Aug. 14	-28.0	Jan. 15	13.82 12.50	-1.26
Helena	42.6	45.4	+2.8	92.7	Aug. 14	-15.5	Jan. 15	16.48 10.99	-5.49
Fort Custer	43.6	46.2	+2.6					14.80 9.65	-5.15
Poplar River		37.6		94.8	July 14	-63.1	Jan. 1	11.92	
Fort Maginnis	38.8	43.5	+4.7	95.6	Aug. 14	-17.0	Feb. 2	11.14 3.90	-7.24
Deadwood	41.2	43.4	+2.2	90.0	July 28	-15.5	Jan. 19	26.11 28.48	+2.37
Cheyenne	44.2	44.0	-0.2	88.2	July 7	-18.6	Jan. 16	11.07 16.12	+5.05
North Platte	47.7	47.1	-0.6	97.6	July 15	-22.2	Feb. 18	19.32 22.03	+2.71
<i>Middle slope.</i>									
Denver	49.2	49.2	0.0	97.3	July 15	-10.9	Jan. 16	14.99 15.95	+0.96
Pike's Peak	19.1	19.2	+0.1	57.0	July 15	-29.4	Jan. 16	29.57 30.48	+0.91
Dodge City	52.8	51.5	-1.3	97.3	July 20	-18.2	Jan. 1	21.11 23.71	+2.60
West Las Animas	49.2	50.2	+1.0	105.2	July 15	-25.9	Jan. 1	13.41 14.23	+0.82
Fort Elliott	54.6	51.4	-3.2	98.8	July 8	-6.0	Jan. 19	23.97 37.07	+3.10
<i>Southern slope.</i>									
Fort Sill	60.6	58.1	-2.5	103.5	Aug. 4	1.0	Jan. 1	33.38 33.05	-0.33
Fort Davis	59.8	60.9	+1.1	97.7	June 12	5.3	Jan. 16	20.38 14.22	-6.16
<i>Southern plateau.</i>									
Prescott	52.1	53.3	+1.2	98.5	July 13	-4.0	Jan. 1	16.04 10.11	-5.93
Fort Grant	60.0	60.6	+0.6	99.6	July 14	20.3	Jan. 1	17.14 9.21	-7.93
Fort Thomas	61.4	61.9	+0.5	105.8	July 14	71.8	Dec. 15	12.77 8.70	-4.07
Fort Apache	52.0	54.1	+2.1	101.4	July 12	-4.0	Jan. 1	23.87 15.58	-8.29
El Paso	63.2	63.0	-0.2	110.1	Aug. 6	12.5	Dec. 15	13.14 7.31	-5.83
Santa Fe	47.9	47.7	-0.2	88.5	July 14	-3.2	Jan. 16	13.89 14.89	+1.00

## Annual mean temperature, etc.—Continued.

Stations.	Temperature.							Precipitation.		
	Normal.	Mean for 1885.	Departure.	Extremes for 1885.				Normal.	Total for 1885.	Departure.
				Maximum.	Date.	Minimum.	Date.			
				o	o	o	o			
Middle plateau.	o	o	o	o	o	o	o	Ins.	Ins.	Ins.
Salt Lake City .....	51.1	52.3	+1.2	100.3	Aug. 16	4.8	Jan. 21	16.97	19.69	+2.72
Winnemucca .....	49.0	51.5	+2.5	94.1	July 14	8.9	Jan. 1	9.62	11.80	+2.18
Northern plateau.										
Lewiston .....	50.4	53.2	+2.8	105.2	Aug. 18	-10.0	Jan. 20	18.05	10.44	+1.39
N. Pac. coast region.										
Olympia .....	49.2	51.8	+2.6	97.0	July 27	22.7	Dec. 11	56.27	41.95	-14.32
Portland .....	52.4	54.5	+2.1	99.0	July 6	7.0	Jan. 1	53.38	39.59	-13.79
Roseburg .....	51.9	54.7	+2.8	100.8	July 6	27.3	Jan. 12	35.72	30.91	-4.81
Fort Canby .....	51.8	51.8	.....	75.4	May 10	30.9	Jan. 11	58.46	.....	.....
Tatoosh Island .....	50.1	.....	.....	74.0	July 5	32.5	Jan. 16	.....	84.18	.....
Mid. Pac. coast reg.										
Cape Mendocino .....	51.3	52.8	+1.6	.....	.....	.....	.....	17.99	20.37	+2.38
Red Bluff .....	60.4	64.4	+2.0	108.0	Aug. 12	33.0	{ Jan. 12 Jan. 25 Dec. 31	28.24	29.63	+1.39
Sacramento .....	59.2	61.2	+2.0	105.0	Aug. 15, 17	34.2	Jan. 24	23.57	20.72	-2.85
San Francisco. ....	55.7	56.9	+1.2	.....	.....	.....	.....	24.03	24.90	-0.87
S. Pac. coast region.										
Los Angeles .....	60.5	63.0	+2.5	108.5	Sept. 2	36.3	Feb. 13	18.25	10.69	-7.56
San Diego .....	60.5	62.0	+1.5	.....	.....	.....	.....	0.88	6.14	-4.74



Connecticut, and Block Island, Rhode Island, the deficiencies were 12.53 and 15.61 inches, respectively.

In the Ohio Valley all stations show deficiencies, the average for the district being 6.12 inches below the normal.

In Tennessee there was a slight excess at Knoxville, and marked deficiencies in the western part of the state, being 10.71 inches, at Nashville, and 18.69 inches, at Memphis.

In the lower lake region there is an average excess of about one-half inch, the extreme departures being a deficiency of 8.47 inches, at Rochester, New York, and an excess of 15.30 inches, at Buffalo, New York.

In the extreme northwest, upper Mississippi valley, and upper lake region there is a general deficiency, except at Chicago, Illinois, excess 7.03 inches; Saint Louis, Missouri, excess 7.71 inches; and Milwaukee, Wisconsin, and Dubuque, Iowa, nearly normal.

All stations in the Missouri valley show an excess, the average for the district amounting to 2.06 inches.

On the Pacific coast there were marked deficiencies in the northern and southern districts, while in the middle Pacific coast region the precipitation averaged about normal.

#### NOTES AND EXTRACTS.

The following extract is from the December, 1885, report of the "Alabama Weather Service," under direction of Prof. P. H. Mell, jr., Auburn:

The month of December has been generally mild and pleasant. Most of the stations reported high temperatures for this season of the year. The cold days of the month were the 6th, 11th, 15th, 27th, and 28th.

The rainfall was below the average over a greater part of the state, and some stations record an inappreciable fall of rain. Trinity, for instance, reported "not enough to measure." In north Alabama there was a slight fall of snow on the 5th and 14th, not enough, however, to cover the ground. Ice and frost occurred frequently during the month, and at times the ground was quite hard frozen.

Some stations reported beautiful sunsets and bright afterglows.

Greensborough furnishes the following items: "We have had the highest and lowest barometer readings for December that have occurred during the several years of my observation, viz., highest, 30.500, lowest, 29.600; range, 0.900."

Trinity states that "the weather for the month of December has been exceptionally fine; not too warm nor too cold. We have had some ice, and a little sprinkle of snow on the 14th. There has been but little rain; some days of misty weather, and once or twice a slight shower. The roads have been better in this country than I ever knew them at this season of the year. The freezes have been light."

Valley Head states that "a gale passed over this place on the night of the 12th. The wind blew at the rate of about fifty miles per hour and continued for several hours. There was no material damage, so far as I know. The rainfall was 1.40 inches. The wind was from the east."

Chattanooga states that "the mean temperature for December was 2° 4 colder, and the total precipitation 2.22 inches less, than the average for the month, while the total movement of wind was two hundred and seventy-six miles greater. The greatest hourly wind-velocity occurred on the 5th, and was thirty-eight miles, blowing from the southwest, which proved also to be the highest velocity occurring during the year. The mean of the minimum temperature was about 5° higher than the average, thus making the month seem warmer than usual, although the actual facts are that it was 2° 4 colder."

Tuscumbia reports for the 20th the following: "To-day, at 12 m., I witnessed a solar halo about 40° in diameter. The sky was overcast with a very thin white cloud, but the sun shone through with some strength. The outer portion of the circle was perfectly white, the centre was of a white milky appearance about 20° in diameter; between these two portions there was a ring of a dark red purplish tint. This halo continued from 12 m. until 4 p. m. At night there was a lunar halo and a corona around Venus."

#### State summary.

Mean temperature, 44° 1; highest temperature, 74°, at Eufaula, on the 9th; lowest temperature, 12°, at Gadsden, on the 6th; range of temperature, 62°; greatest monthly range of temperature, 50°, at Eufaula; least monthly range of temperature, 39°, at Jacksonville; mean daily range, 16° 1; greatest daily range of temperature, 38°, at Gadsden, on the 4th; least daily range of temperature, 0°, at Centre, on the 1st.

Mean depth of rainfall, 2.87 inches; mean daily rainfall, 0.093; greatest depth of monthly rainfall, 6.25 inches, at Gadsden; least depth of monthly rainfall, inappreciable, at Mount View; greatest daily rainfall average for state, 1.90 inches, on the 13th; greatest daily local rainfall, 4.18 inches, at Mobile, on the 6th.

Average number of days on which rain fell, 6; average number of cloudy days, 9; average number of fair days, 8; average number of clear days, 14; warmest days, 4th and 8th; coldest days, 6th, 11th, 15th, 27th, 28th.

Prevailing direction of wind, northwest.

The following letter has been received from Mr. Ellwood Cooper, of Santa Barbara, Santa Barbara county, California:

SANTA BARBARA, December 12, 1885.

Brig. Gen'l HAZEN, Washington:

DEAR SIR: My last report to your department was partially published in the WEATHER REVIEW of April, 1884. That report gave the rainfall from 1870 to, and including, that of the winter of 1883-'84. The rainfall of 1884 and 1885 was 12.56 inches, 9.12 inches falling from October 8th to December 31st, and 3.86 falling from January 1st to May.

From my letter containing the information given in the report, as stated above, I laid down the theory that during the winters when we had heavy rains before January 1st we were likely to have light rains after January 1st. In support of this I called your attention to the winters of 1871-'72, 1878-'79, and 1880-'81; I have now to add the rainfall of the past winter, demonstrating the same condition as the three winters above alluded to. I also wrote in said communication that during the spring of 1884 we had a series of warm south winds, which caused the unprecedented rainfall of that season, and that since my sojourn in the country, from 1870 down to that time, that the wind had not blown one single hour steadily from that quarter. In my theories there laid down and (?) the statement that by close observation we could, to a certain extent, foretell the probable rainfall each winter.

I now beg to call your attention to the storm of November last, commencing the 15th and ending the night of the 24th. (I was not at home, or I should have reported earlier.) There is no record of so much rain falling in any year, since records have been kept, in the month of November. I have learned from my wife and the men working on the ranch that a very warm wind blew from the southeast (more southerly than easterly), and part of the time due south, the wind on two different days and nights amounting to a gale; many of my fruit trees were uprooted, some broken square off above the ground. This storm commenced apparently without any preparation. In Los Angeles county, twenty miles from the sea, there were no violent winds. I am therefore convinced that there must have been a strong wind blowing from the Gulf of California some time previous to the commencement of the storm here.

Our usual southeast storms cross the country north of Fort Yuma, giving at San Diego about one-third as much rain as at Santa Barbara. The storm of November just passed, the greatest amount of rain was condensed between the first and second ranges of mountains; at the base of the Sierra Madre there were 7 inches of rainfall; at Newhall, 9 inches; in the Ajai Valley, 15; in the Santa Inez Valley, back of Santa Barbara, 19; and at San Luis Obispo, 22 to 24 inches. On the night of the 17th 9 inches of rain fell in a few hours at the latter place. In the town of Los Angeles, 6 inches; Santa Barbara, 9 inches; at Ellwood (my home), 10 inches; at the south base of the Santa Inez range, Glen Annie, there were 14 inches, while at the base on the north side there were 19 inches. This warm wind blowing from the mouth of the Gulf of California was kept westward of the high range on the peninsula and carried directly over the first ranges from San Pedro to Point Conception; on reaching the second ranges, was met by the cold northwest trades, condensed, and hence the greatest precipitation in the valleys back from the coast. In the Paso Robles country there was not much rain, probably, from the reports, about 4 inches. We have had up to date since October 15th, 10.37 inches of rain, and according to my theory we must not expect very much more after January 1st. I do not predict, but the fact that every winter since 1870 that gave us 8 inches or more before January 1st, gave us but little after January 1st. This very strong probability should put farmers and fruit growers on their guard, and they should lose no time in preparing for such an alternative.

I have the honor to be your obedient servant,

ELLWOOD COOPER.

Since the receipt of the above, Mr. Cooper has furnished the following summary:

The review of the rainfall from 1870 to date, establishes thus far one unvarying rule, and that is, that in all our rain seasons, when there has been more than half our winter average of rain before January 1st, we have had less after January 1st, in the ratio or proportion as the amount before was greater. For example:

Season.	Before January 1.	After January 1.	Total.
	Inches.	Inches.	Inches.
1871-'72 .....	8.50	7.44	15.88
1878-'79 .....	8.12	6.38	14.50
1880-'81 .....	13.50	3.06	16.56
1884-'85 .....	9.12	3.44	12.56
1885 .....	13.44	.....	.....

While I do not pretend to know, or to predict, how much more rain we will have before the end of spring, the above table should warn every farmer and fruit-grower of the necessity of preparing their work with the expectation of having but little more. The season thus far for the cultivator is the best we had in sixteen years, and any failure in crops will be the result of neglect on the part of the farmer.

SANTA BARBARA, December 31, 1885.

The following meteorological summary and accompanying remarks are from the December, 1885, report of the "Indiana

Weather Service," under direction of Prof. H. A. Huston, of Purdue University, Lafayette:

Districts.	Temperature.			Average precipitation.
	Highest.	Lowest.	Monthly mean.	
Northern counties .....	60.0	- 8.0	29.31	2.56
Central counties .....	59.0	-10.0	31.26	2.38
Southern counties .....	62.0	0.0	34.24	2.70
State .....	62.0	-10.0	31.57	2.55

The mean temperature of the state for December, 1885, was 0°.3 above the mean of the state for the past three Decembers; 1°.47 below the mean of fourteen years at Indianapolis; 3°.65 above the mean of twenty-six years at Logansport; 2°.03 below the mean of twenty-one years at Vevay; 2°.27 above the mean of thirty-two years at Spiceland; 5°.76 above the mean of six years at Maury; 1°.83 below the mean of eight years at Blue Lick; 0°.08 above the mean of four years at Worthington, and 4°.27 above the mean of six years at this station. With the exception of Indianapolis, the mean temperature at the various stations was above the normal, the amounts ranging from 1° to 6°.2.

The mean precipitation for the state is 1.66 inches below the mean for the past three Decembers; 0.76 inch below the mean of fourteen years at Indianapolis; 1.68 inches below the mean of twenty-one years at Vevay; 0.39 inch above the mean of twenty-six years at Logansport; 0.38 inch below the mean of twenty-six years at Spiceland; 1.74 inches below the mean of four years at Blue Lick; 0.58 inch below the mean of four years at Worthington; and 0.64 inch below the mean of six years at this station. With two exceptions, the precipitation at the various stations is below the normal, the amounts ranging from 0.5 to 2.2 inches.

High winds prevailed in all parts of the state between the warm weather of the 4th and the cold wave of the 7th.

The following is the "Iowa Weather Bulletin" for December, 1885, prepared by Dr. Gustavus Hinrichs, director of the State Weather Service:

December, 1885, was very moderate, with excess of precipitation, westerly winds prevailing.

The mean temperature of the air was one and a half degrees above the normal. The first two decades were cold, averaging six degrees below normal, with three very cold groups of three days each, namely, the 9-11th and 12-14th, averaging fifteen degrees below normal, and the 5-7th, averaging eighteen degrees below normal. The last decade was decidedly warmer, being fifteen degrees above normal, and having two three-day groups, the 21st-23d, 28-30th, which were twenty degrees above normal, corresponding to the normal temperature at the beginning of April.

Cloudiness averaged normal for the month, but was in excess during the first and third decades, and much below normal during the middle decade, which was marked by many sunny days, with remarkably high insolation. This decade also comprised the sleighing season. The seven days, from the 15th to the 21st, were as fine winter days as can be experienced anywhere.

Precipitation was nearly fifty per cent. in excess of normal. The principal snow fell on the 9th, and gave fair sleighing, which lasted until about the 21st. The four days from the 27th were rainy and cloudy, and gave over one inch of water in many places.

No remarkable phenomena were noted. Silver thaw on the 18th; fog on the 17th and 29th. The only high northwest wind began on the 4th and continued into the 5th. The total run of the wind for the month was nearly normal. The number of days on which the temperature reached to, or fell below, zero (Fahrenheit) was six, one less than normal.

December, 1885.	Temperature.		Rainfall.
	Mean.	Departure.	
First decade .....	19.5	- 6.8	0.54
Second decade .....	18.2	- 5.0	0.24
Third decade .....	35.3	+15.1	1.30
Month .....	24.7	+ 1.6	2.83

The following is an extract from a meteorological summary for 1885, furnished by Prof. F. H. Snow, of the University of Kansas, Lawrence, Kansas:

The chief meteorological peculiarities of the year 1885 were the low temperature of all its months, except November and December; the ample and remarkably well-distributed rainfall; the low aggregate velocity of the wind for every month but August, and the most extraordinary daily wind-velocity on our record (December 4th).

**Temperature.**—The mean temperature for the year, 51°.01, which is 2°.28

below the mean of the seventeen preceding years; the highest temperature was 96°, on July 16th; the lowest was -14°.5, on the 10th of February, giving a range of 110°.5. The mean temperature of the winter months, 24°.04, which is 5°.47 below the average winter temperature; of the spring, 52°.41, which is 1°.27 below the average; of the summer, 74°.28, which is 1°.64, below the average; of the autumn, 53°.33, which is 0°.43 below the average. The coldest month of the year was January, with mean temperature 18°.74; the coldest week was January 15th to 21st, mean temperature, 1°.68; the coldest day was February 10th, mean temperature, -4°.12. The mercury fell below zero on twenty-one days, of which thirteen were in January, seven in February, and one in December. The warmest month was July, with mean temperature, 77°.06; the warmest week was July 18th to 24th, mean, 81°.66; the warmest day was July 15th, mean, 84°.75. The mercury reached or exceeded 90° on twenty-seven days (fourteen less than the average number), viz., three in June, seventeen in July, and seven in August. The last hoar frost of spring was on May 8th, the first hoar frost of autumn was on October 4th, giving an interval of one hundred and forty-nine days, or nearly five months, entirely without frost; the average interval is one hundred and fifty-five days. The last severe frost of spring was on April 13th; the first severe frost of autumn was on October 6th, giving an interval of one hundred and seventy-six days, or nearly six months, without severe frost; the average interval is one hundred and ninety-nine days; no frost during the year caused damage to crops of grain or fruit, but the low temperatures of January and February were generally destructive to peach buds.

**Rain.**—The entire rainfall, including melted snow, was 36.97 inches, which is 1.79 inches above the annual average; either rain or snow, or both, in measurable quantities, fell on one hundred and three days—one less than the average; on twenty other days rain or snow fell in quantities too small for measurement. There was no approach to drought during the year, the longest interval without rain in the growing season being ten days, from August 12th to 22d. The number of thunder showers was thirty-one; there were two light hail storms during the year.

**Snow.**—The entire depth of snow was 33 inches, which is 12.13 inches above the average; of this amount, 8 inches fell in January, 11 inches in February, 4 inches in March, and 10 inches in December; snow fell on twenty-seven days; the last snow of spring was on March 27th; the first snow of autumn was on November 12th—four days later than the average date.

The mean cloudiness of the year was 44.57 per cent., which is 0.08 per cent. below the average.

The prevailing direction of the wind was southwest.

The average atmospheric humidity for the year was 71.3; the dampest month was January, with the mean humidity 83.0; the driest month was November, mean humidity, 65.0.

The following is an extract from the December, 1885, report of the "Minnesota Weather Service," under direction of Prof. Wm. W. Payne, Carleton College, Northfield:

The average mean temperature of Minnesota for December, as deduced from reports from seventeen stations of the Minnesota Weather Service, is 19°.5. This is 12°.6 colder than the preceding month of November, but much above the average for the month. The warmest station was La Crosse, with a mean for the month of 26°.3; the next warmest was Winona, 23°.5. The coldest stations were Saint Vincent, Park Rapids, and Moorhead, 11°.6, 14°.0, and 15°.3, respectively. The highest temperature, with few exceptions, occurred on the 22d. High temperatures recorded were: Grand Forks, 45°.0, 2d; Crookston, 45°.0, 28th; Winona, 54°.0, 22d, and Park Rapids, 43°.1, on the 27th. The minimum temperatures, as in November, were very high, as compared with the usual greatest cold for the month, being, with but one exception, above -20°.5. The effect of this comparative evenness was to cause the month to be marked by delightful weather throughout all parts of the north-west. The observer at Grand Forks, in the Upper Red River Valley, under date of the 26th, says: "The last fifteen days have been exceptionally mild for the season. The weather has been clear, and the temperature, under the influence of the prevailing light southwest winds, has, upon nearly every day, been above the freezing point."

Though several Decembers since 1870 have been materially warmer than the present, yet December, like November, has been a warm month, the mean temperature for the month being much above the average of the last fifteen years. The mild weather of the last November was carried into December, until the 4th, when the equilibrium of the air was disturbed by a storm-centre, or area of low pressure, which rapidly advanced from the Northwest Territory during the 3d and 4th and passed to the Saint Lawrence Valley on the 5th. The contrasts in the weight of the air were very great during the passage of this low area over the state, thereby causing heavy gales and stormy weather, and a cold wave which extended to all sections. Wind-velocities were noted, as follows: Northfield, north, forty-six miles per hour; Bird Island, northwest, forty-six miles per hour.

From the 5th to the 15th the weather was cold, but not unseasonably so, and the minimum temperatures of the month were generally registered during this period. On the 15th the weather began to grow warmer, and from that date to the end of the month the weather was continually mild, with thaws on many days, so much so that the snow disappeared; and the ice in the rivers, which were generally closed on the 5th, was covered with water, and a break-up seemed imminent. There was an unusual number of foggy days, and on the 22d, 26th, 27th, 28th, and 29th rain was noted in various localities.

The snowfall for the month was generally small, the most of it occurring on



the 4th and 8th. On the 15th there were from six inches on the ground, in the southeast, to three inches, in the northwest; but this generally disappeared by the 22d, leaving the ground bare, much to the detriment of the logging and other interests which depend on an abundance of snow, and at the end of the month prospects were discouraging for a full cut in the lumbering districts. But two stations, Winona and La Crosse, report more than one inch of precipitation; 1.93 and 1.79 inches, respectively.

The following is an extract from the December, 1885, report of the "Missouri Weather Service," under direction of Prof. Francis E. Nipher, Washington University, Saint Louis:

December has been somewhat warmer than the normal (about 2°) and has a deficiency of rainfall of about 1 inch.

The mean temperature of the first decade was 30° and that of the second 32°.5, both being slightly below normal December weather. The third decade was about 43°.1, or about 10° above the normal.

The lowest temperature reached was 4°, on the 14th. The minimum temperature fell below 32° on thirteen days, and on eight days it did not rise above 32°. The highest temperature reached was 60°.8.

The rainfall was about equally divided among the three decades, falling as snow during the first two.

In the state the rain was less than one inch in the north part of the state and in the region drained by the Osage River, and increases to over three inches in a small region south of Saint Louis.

The lowest temperatures reported are, Chamois, -11°; Mascoutah, -10°; and Mexico, -7°. The highest temperatures are, Chamois, 72°, and Steelville, 65°.

A heavy wind on the 4th, which was felt in the northwest part of the state in the early morning and at 7 o'clock at Glasgow, reached Chamois at 9 o'clock and arrived at Saint Louis about 4 p. m. It was strong enough to overthrow old buildings and to unroof houses, and did extensive damage. It was attended with a marked fall of temperature.

Chamois reports the month as 2° above the average of the last ten years.

The following is an extract from the December, 1885, "Bulletin of the New England Meteorological Society," under direction of Prof. Winslow Upton, Providence, Rhode Island:

Reports for the month were received from one hundred and thirty-five observers.

**General conditions.**—The month was warm, with a large number of fair days, and a deficiency of rain and snow.

**Precipitation.**—The amount and distribution of the precipitation were very irregular. There was also great variability in its character, whether rain or snow. In the northern portion there was considerable snow, but in the southern portion little or no snow fell during the month. Throughout the district the snowfall was less than the usual amount in December.

**Temperature.**—With few exceptions the temperature was above the average at stations where a comparison with former records can be made. There was also an absence of extremely low temperature, only a few readings below zero having been reported. In this respect the month differed widely from December, 1884, in which nearly every station reported temperatures below zero, on the 20th.

**Pressure.**—Ten depressions, with the usual attendant conditions, passed in the vicinity of the district, all moving rapidly. Seven of these moved in the usual path from the Lakes down the Saint Lawrence Valley; one (13th-15th) from the Ohio Valley down the Saint Lawrence; and two (26th-27th and 31st) up the Atlantic, east of the coast. Two in the first class were secondary depressions, which formed out of the same conditions as earlier depressions, and immediately followed in their track. The highest pressure of the month was about 30.7 inches, on the 12th.

**Wind.**—High westerly winds attended the advance of a wave of high pressure (30.8 inches) on the 7th, and very severe gales were experienced on the coast on the 26th and 27th, in connection with the depression moving up the Atlantic on those dates. The tide was high, and much damage was done to vessels and in the coast towns.

**Miscellaneous.**—Auroras were generally noted on the 1st, 6th, and 7th; on the 4th, at Saint John; on the 8th, at Belfast and Walpole; and on the 9th, at Kent's Hill.

Lightning and thunder were noted as follows: 3d, South Hingham, lightning in southeast in evening; Kent's Hill, 10.30 p. m., lightning flash in east, below horizon; 6th, Nantucket, sharp lightning in evening; South Hingham, lightning in evening in southeast and south; 19th New Bedford, thunder and lightning in morning, during rain storm; Nantucket, thunder, 8.20-11.10 a. m., with wind squall, during rain storm.

#### The year 1885.

The meteorological conditions of the year were especially favorable for agriculture. There was little damage from late frosts in the spring, or from early frosts in the fall, and the rainfall was abundant. The season was about normal in time, from spring to autumn.

The precipitation record shows an average deficiency over that of previous years, but there are marked irregularities. It is quite probable that some of these irregularities arise from the fact that the records were made under different conditions in different years. This is one of the most fruitful sources of error in combining precipitation records, and seriously impairs the value of

comparative tables. There were many instances of excessive rainfall in individual storms, especially in July and August.

In the early part of the year, there occurred a period of almost unprecedented cold, lasting from the middle of January to the end of March. The spring and summer were somewhat below the average temperature, and autumn above it, giving a decided deficiency for the year.

The thunder-storms of the summer were numerous and severe. Lightning also attended a few of the general storms of the winter. Severe gales were noted in several months, those in the last three months of the year having caused considerable damage on the coast.

The following is an extract from the December, 1885, report of the "Ohio Meteorological Bureau," under direction of Prof. Benjamin F. Thomas, of the Ohio State University, at Columbus:

A comparison of the reports for December, 1885, with those for the same month in the three preceding years shows that the principal differences were experienced in the atmospheric pressure, temperature, and precipitation.

The mean pressure was 0.37 inch lower than the lowest of the years named, and 0.46 lower than their mean. The lowest pressure was 29.113, on the 4th, the lowest shown by the records of the bureau. This low pressure marked the beginning of the severest storm of the month.

The mean temperature, 32°.4, was 1°.8 above the mean of the three years preceding, and 0°.37 above the normal. The extreme range of the temperature from 6°.8, on the 7th, to 71°.0, on the 9th, accompanied the storm alluded to above.

The mean rainfall reported was 1.76 inches, the least on our records for December, and 1.48 inches, or forty-six per cent., below the normal. The low pressure and somewhat high temperature prevailing would lead one to expect a rainfall above the average, and an examination of the relation between pressure, temperature, and precipitation for each of the three preceding years would confirm the expectation. The month's record is in this respect exceptional.

#### State summary.

**Atmospheric pressure.**—Mean for the state, 30.10; highest, 30.78, on the 12th, at Canton; lowest, 29.11, on the 4th, at Wauseon; range for the state, 1.66.

**Temperature.**—Mean for the state, 32°.4; highest, 71°, on the 9th, at Hanging Rock; lowest, -6°.8, on the 7th, at Wauseon; range for the state, 77°.8; mean daily range, 16°.6; greatest daily range, 49°.4, at Oberlin; least daily range, 1°.0, on the 31st, at Logan.

**Relative humidity.**—Mean for the state, 79.8 per cent.

**Precipitation.**—Average for the state, 1.74; average daily, 0.057; greatest monthly, 2.97, at New Alexandria; least monthly, 0.50, at Ainger.

Average number of clear days, 5.1; fair days, 9.7; cloudy days, 16.2; on which rain fell, 12.5; greatest number of days on which rain fell, 20, at Sandusky; least number of days on which rain fell, 5, at Springborough.

Prevailing direction of the wind, southwest.

The following is an extract from the Tennessee "State Board of Health Bulletin," for December, 1885, prepared under direction of J. D. Plunkett, M. D., President of the State Board of Health. The summary is prepared by Major H. C. Bate, in charge of the State Meteorological Service:

The weather during the month of December was, for the most part, remarkably mild and pleasant, with but few special features, the principal being the high winds which prevailed during the first week.

The mean temperature was 39°.41, only 0°.27 above that for December, 1884, and 3°.46 below that for December, 1883. The maximum temperature, recorded about the 4-9th, was the same as the December maximum of 1884, and 6° below that of 1883. The minimum temperature, recorded about the 15th, was the same as that of 1883, and 13° above the December minimum of 1884.

The average rainfall was 3.19 inches, 2.13 inches less than the December average for the year previous, and 1.12 inches less than that for 1883. As during the past three months, the eastern division of the state received the largest portion, averaging nearly four inches. The middle division received but little over three inches, while the western division received only two and three-fourths inches. The rains of the 9th and 13th were quite heavy, especially in the eastern division. The greatest local daily fall was 2.80 inches, reported on the 9th, at Andersonville. The days of the greatest rainfall were the 1st, 8th, 9th, 13th, 23d, 30th, and of these the greatest fall occurred on the 9th. These, together with the 12th, were general rains. No rain was reported on the 16th, 17th, 19th, 20th, 21st and 26th.

There were only three or four slight falls of snow during the month, scarcely sufficient to measure. They occurred on the 5th, 14th, and 25th, in the eastern division; the 5th and 14th, in the middle division; and the 5th and 13th, in the western division. The greatest depth reported was 0.90 inch, at Farmingdale.

#### State summary, December, 1885.

Mean temperature, 39°.41; highest temperature, 72°, on the 9th, at Jonesborough; lowest temperature, 12°, on the 15th, at Fostoria and Trenton; range of temperature, 60°; mean monthly range of temperature, 46°.97; greatest monthly range of temperature, 58°, at Fostoria; least monthly range of temperature, 38°, at Greenville; mean daily range of temperature, 15°.75; greatest daily range of temperature, 50°, on the 11th, at Fostoria; least daily range of

temperature, 2°, on the 1st, at Greenville and Rogersville; on the 8th, at Howell; on the 9th, at Lexington; on the 10th, at Cookeville; on the 13th, at Parkesville, and on the 21st, at Hurricane Switch; mean of maximum temperatures, 64°.34; mean of minimum temperatures, 17°.37.

Mean depth of rainfall, 3.19 inches; mean daily rainfall, 0.103 inch; greatest rainfall, 5.03 inches, at Andersonville; least rainfall, 1.46 inches, at Greenville; greatest local daily rainfall, 2.80 inches, on the 9th, at Andersonville; days of greatest rainfall, 1st, 8th, 9th, 13th, 23d, 30th; day of greatest rainfall, 9th.

Average number of days on which rain fell, 7.2; average number of clear days, 9.5; average number of fair days, 11.7; average number of cloudy days, 9.8; average snowfall, 0.19 inch; greatest snowfall, 0.90 inch, at Farmingdale; rainless days, 16th, 17th, 19th, 20th, 21st, 26th; warmest days, 4th, 9th; coldest days, 11th, 15th, 27th.

Prevailing wind, northwest.

#### Annual summary, 1885.

A comparison of the annual summary with those of the two preceding years shows the mean temperature for the past year to be slightly below the means for those two years. The maximum temperature recorded, 102°, was 3° above that for 1884 and 4° above that for 1883. The recorded minimum, -4°, was 14° below that for 1884. The actual minimum temperature for 1883 is not included in the summary for that year, as the observations of temperature did not begin until April.

The average rainfall is shown to be 11.21 inches less than the average for 1884, and only 1.93 inches more than the average of 1883, in which January is not included, and February only partially. For the past year Andersonville reports the greatest total rainfall, 59.26 inches, and Florence Station the least, 39.27 inches; these are from complete reports. The total rainfall at Covington for eleven months, November not being included, was 27.55 inches, which would make that station show the least rainfall, allowing even a liberal estimate for the month omitted. These gaps in the annual summaries, and the consequent difficulty in reaching actual estimates are much to be regretted, and should impress upon observers the great necessity and value of an unbroken record of their individual observations. Nashville shows the greatest total of rainy days, recording one hundred and sixty-one. January was the month of the greatest rainfall, having an average of 6.96 inches, and August the least, or 2.30 inches.

During the past month the percentages of verifications of the temperature and weather predictions, according to the signals adopted by the state board of health, displayed daily from the signal office in this city, were as follows: Temperature, 90.3 per cent.; weather, 93.5 per cent. During November and December, for forty-two consecutive days, the predictions, as displayed by the flags, were fully verified.

Prof. J. A. Laughlin, voluntary observer at Hurricane Switch, Maury county, contributes the following annual data from his station: Average temperature, 55°.4; maximum temperature, 95°.5; minimum temperature, 1°.9; range of temperature, 93°.6; total rainfall, in inches, 40.85; number of days on which rain fell, 110; total fall of snow, in inches, 6.3; number of days on which snow fell, 14; number of fogs, 27; number of hails, 3; number of dews, 122; number of frosts, 72; number of clear days, 103; number of fair days, 130; number of cloudy days, 132; prevailing direction of wind, southwest.

The same observer contributes the following valuable data, the result of his observations, showing the value of solar and lunar halos and coronae as indications of coming rain or snow. "During the year 1884 and 1885 nineteen solar and thirty-one lunar halos were observed. Of these, thirteen were followed by rain or snow on the same day, twenty-six on the first day after, twenty-six on the second day after, eighteen on the third day after, while seven were followed by no rain or snow. That is, 86 per cent. of the number of halos were followed by rain or snow within three days after they were seen. During the same time fourteen coronae were recorded, thirteen, or about 93 per cent., of which were followed by the expected weather within three days."

Mean temperature for the state, 56°; highest temperature, 102°, August 9th, at Sailor's Rest; lowest temperature, -4°, February 11th, at Sunbright; range of temperature, 106°; mean daily range of temperature, 15°.92; greatest daily range of temperature, 50°, December 11th, at Fostoria; least daily range of temperature, 1°, January 6th, at Bolivar; 24th, at McKenzie and Trenton; February 8th, at Trenton and Sweetwater; 15th, at Grassy Cove; 16th, at Bolivar; 24th, at Savannah and Henderson; 26th, at Sweetwater; March 1st, at Andersonville; 12th, at Cookeville; 15th, at Sweetwater; 22d, at Hardison's Mills and Pulaski; November 19th, at Riddleton, Florence Station, and Howell.

Number of clear days, 121.4; number of fair days, 117.1; number of cloudy days, 126.5; number of days on which rain fell, 109.5; mean number of clear days per month, 10.1; mean number of fair days per month, 10; mean number of cloudy days per month, 10.5; mean number of days on which rain fell per month, 9.1; greatest number of days on which rain fell at any one station, 151, at Nashville; least number of days on which rain fell at any one station, 72, at Bolivar.

Total average rainfall, 44.36 inches; average monthly rainfall, 3.70 inches; greatest average monthly rainfall, 6.96 inches, in January; least average monthly rainfall, 2.30 inches, in August; greatest yearly rainfall at any sta-

tion, 59.26 inches, at Andersonville; least yearly rainfall at any station, 39.27 inches, at Florence Station; greatest monthly snowfall, 12 inches, in March, at Milan.

The prevailing winds, northwest and southwest.

Table of comparison of the years 1883, 1884, 1885.

	1883.	1884.	1885.
Mean temperature.....	61°	57°.33	56°
Highest temperature.....	95°	98°	102°
Lowest temperature.....	10°	-16°	-4°
Range of temperature.....	85°	114°	106°
Mean daily range of temperature.....	17°	18°	15°.92
Greatest daily range of temperature.....	45°	49°	50°
Least daily range of temperature.....	1°	1°	1°
Number of clear days.....	107	117	121.4
Number of fair days.....	84	105	117.1
Number of cloudy days.....	115	144	126.5
Number of days on which rain fell.....	80	109	109.5
Mean rainfall.....	42.43	55.57	44.36
Average daily rainfall.....	0.138	0.152	0.121
Greatest rainfall.....	54.02	69.24	59.26
Least rainfall.....	30.84	44.50	39.27
Mean number of clear days per month.....	8.7	9.7	10.1
Mean number of fair days per month.....	7.0	8.7	9.8
Mean number of cloudy days per month.....	11.5	12.1	10.5
Mean number of days on which rain fell.....	8	9	9.1
Mean monthly rainfall.....	4.24	4.63	3.70
Prevailing direction of wind.....	n. and sw.	n. and sw.	n. and sw.

a July 27th; August 23d. b November 17th. c December 11th. d July 4th, 6th, 14th, 15th, 30th; October 3d, 18th, 21st, 22d, 24th; November 11th, 22d, 25th. e At Bolivar. f At Greenville. g July 4th, 9th; August 29th; October 3d. h January 6th. i October 19th. j January 2d, 15th, 24th; February 7th, 8th, 14th, 27th; March 13th; April 10th, 12th, 14th, 22d, 23d, 28th; May 8th, 25th, 26th; June 3d, 10th, 11th; July 26th, 30th; September 17th, 25th; October 9th, 27th; November 19th, 28th; December 5th, 12th, 13th, 15th, 21st, 28th, 29th, 30th. k At Riddleton. l At Greenville. m August 9th. n February 11th. o December 11th. p January 6th, 24th; February 8th, 15th, 16th, 24th, 26th; March 1st, 12th, 15th, 22d; November 19th. r At Andersonville. s At Florence Station.

The following meteorological summary and accompanying remarks are from the December, 1885, report of the "Indiana Weather Service," under direction of Prof. W. H. Ragan, of De Pauw University, Greencastle:

Districts.	Temperature.			Average precipitation.
	Highest.	Lowest.	Monthly means.	
Northern counties.....	60.0	-10.0	28.9	Inches. 3.32
Central counties.....	56.0	-10.0	31.3	3.70
Southern counties.....	62.0	-2.0	34.6	2.59
State.....	62.0	-10.0	31.6	2.87

The barometer fluctuations were numerous and rapid, but not generally of great force, during the month. The lowest reading of the year occurred on the 9th. A low of considerable force, from northwest, which curved to northeast across the north end of the state on the afternoon of the 4th, and the cold wave that followed on the 7th were the most remarkable features of the month's weather. Thunder-storms occurred at some central stations in connection with a low, passing from south to north, central at the time in Missouri, on the evening of the 8th.

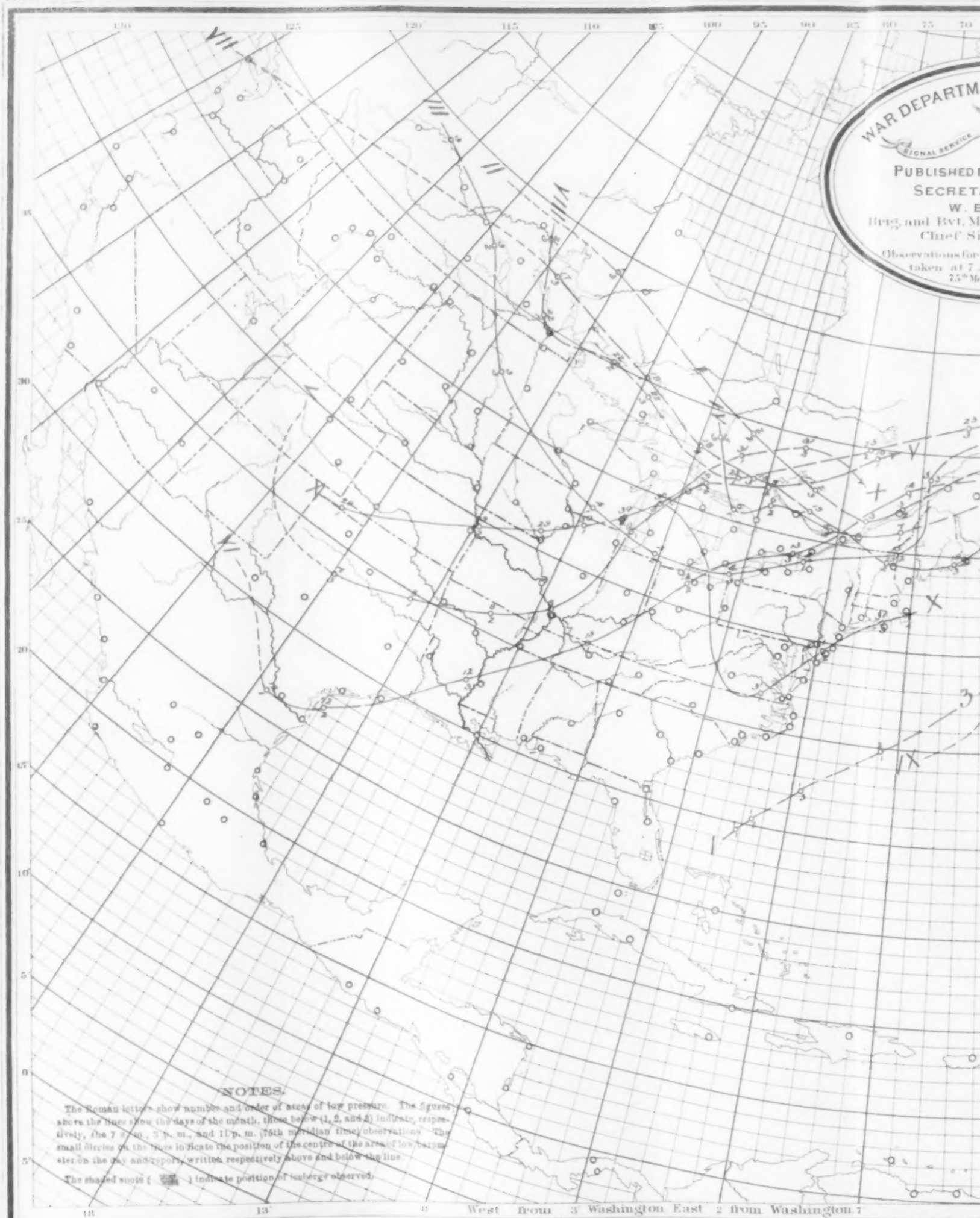
There were no pronounced cold waves. The nights were moderate, and the range of temperature small. The average minimum, at Greencastle, was 25°.0, against 20°.5 same month last year; range 56°.9, against 73°.8. The average was 2°.8 above normal at Logansport, 1°.5 above at Spiceland, 0°.5 below at Indianapolis, 2°.3 above at Vevay, 6°.4 above at Maury, 1°.3 above at Worthington, 1°.9 above at Blue Lick; and for the state, 0°.6 above 1882, 2°.1 below 1883, 3°.0 above 1884, 0°.4 above the mean for four years. For the year the mean was 2°.0 below normal at Logansport, 0°.1 below at Spiceland, 3°.4 below at Indianapolis, 2°.1 below at Vevay; and for the state, 1°.2 below 1883, 2°.6 below 1884, 1°.3 below normal.

The precipitation was well distributed through the month and over the state. Principal falls occurred on the 8th to 9th, 13th, 23d, 29th to 30th. No rain fell on the 2d, 2d, 15th, 16th, 19th, 20th. Snow is reported on seventeen days in the north, fourteen in the centre, and nine in the south; rain or snow at one or more stations on twenty-four days.

The Chief Signal Officer has received the "Monthly Bulletin of the Commissioner of Immigration for Dakota" for December, 1885, prepared under the direction of Lauren Dunlap, esq., at Huron. The report contains a very complete and interesting meteorological summary of the "Dakota Weather Service" for November, 1885.









of Low Pressure, December, 1885.

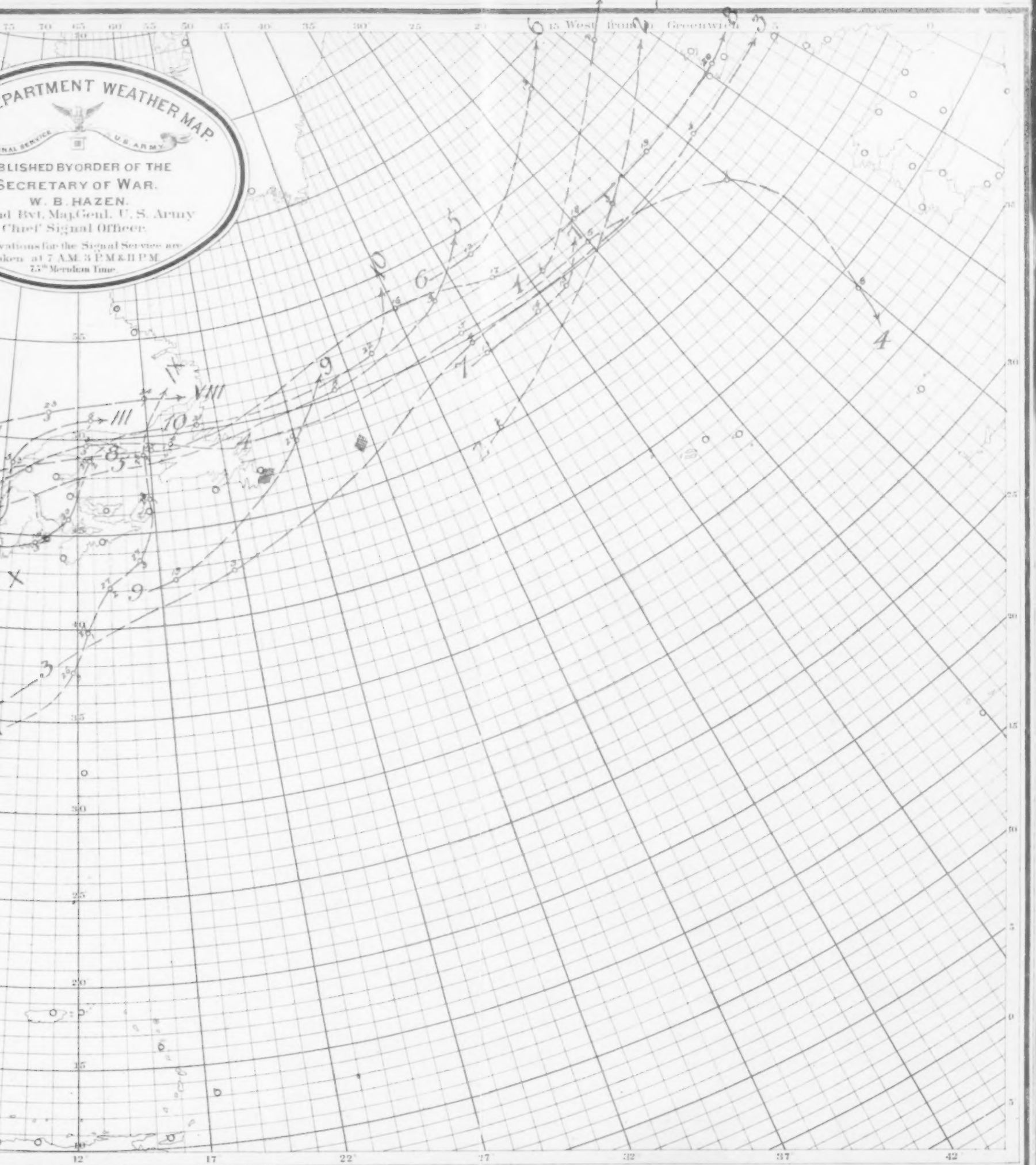
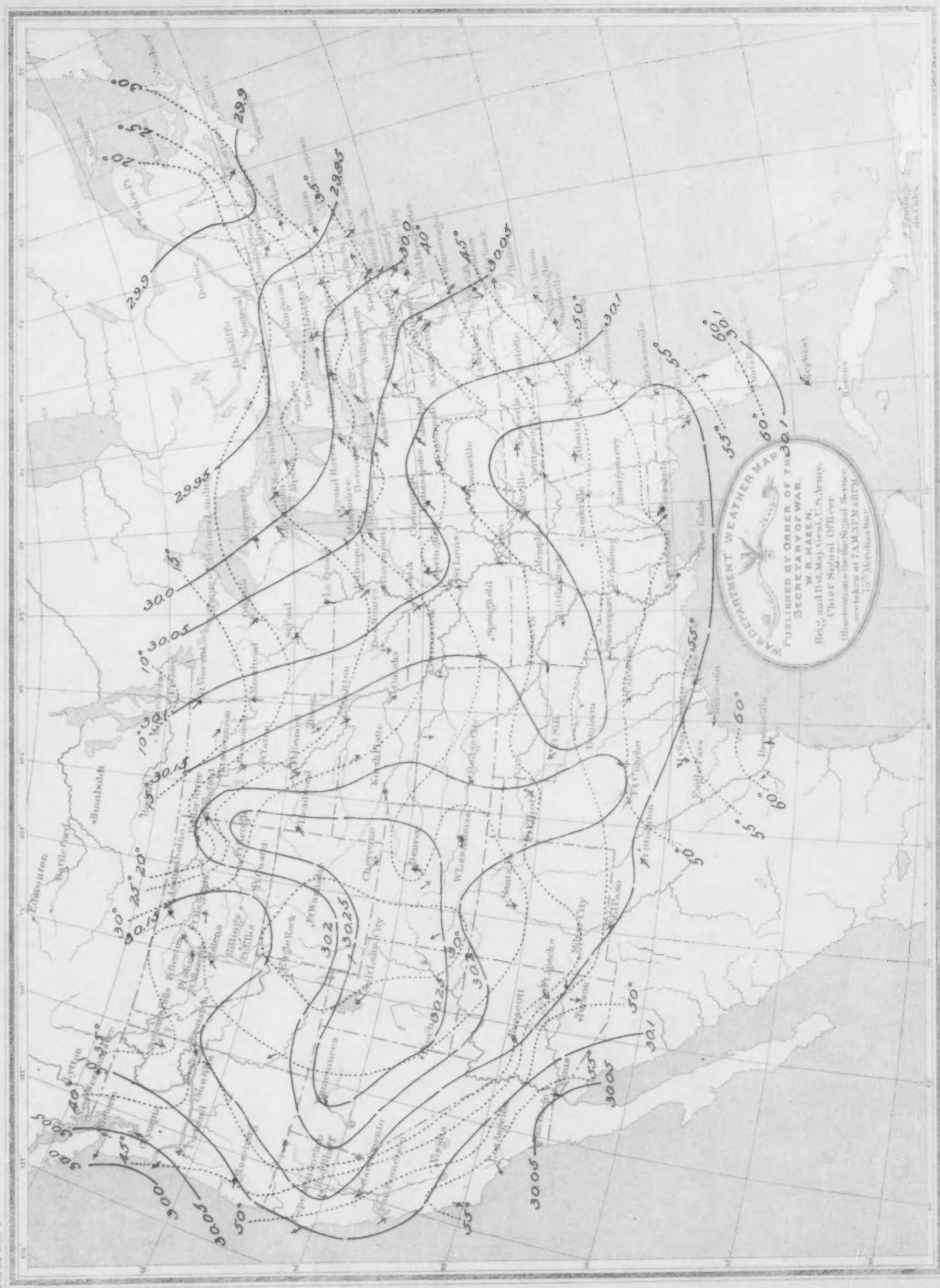






Chart II. Isobars, Isotherms, and Winds, December, 1885.







# Chart III. Precipitation, December, 1885.

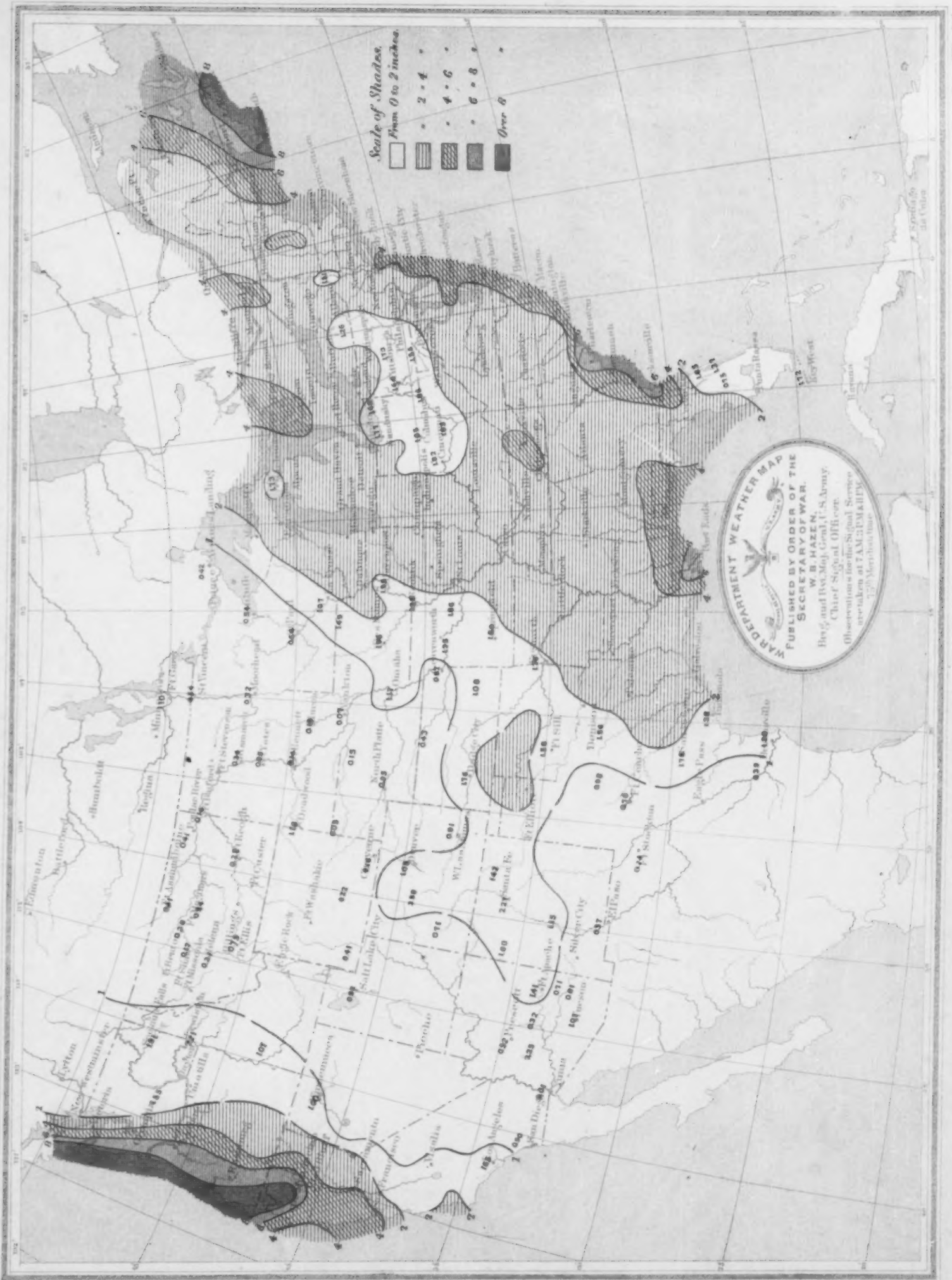












Chart V. Annual Mean Temperature, 1885, and Departures from the Normal.

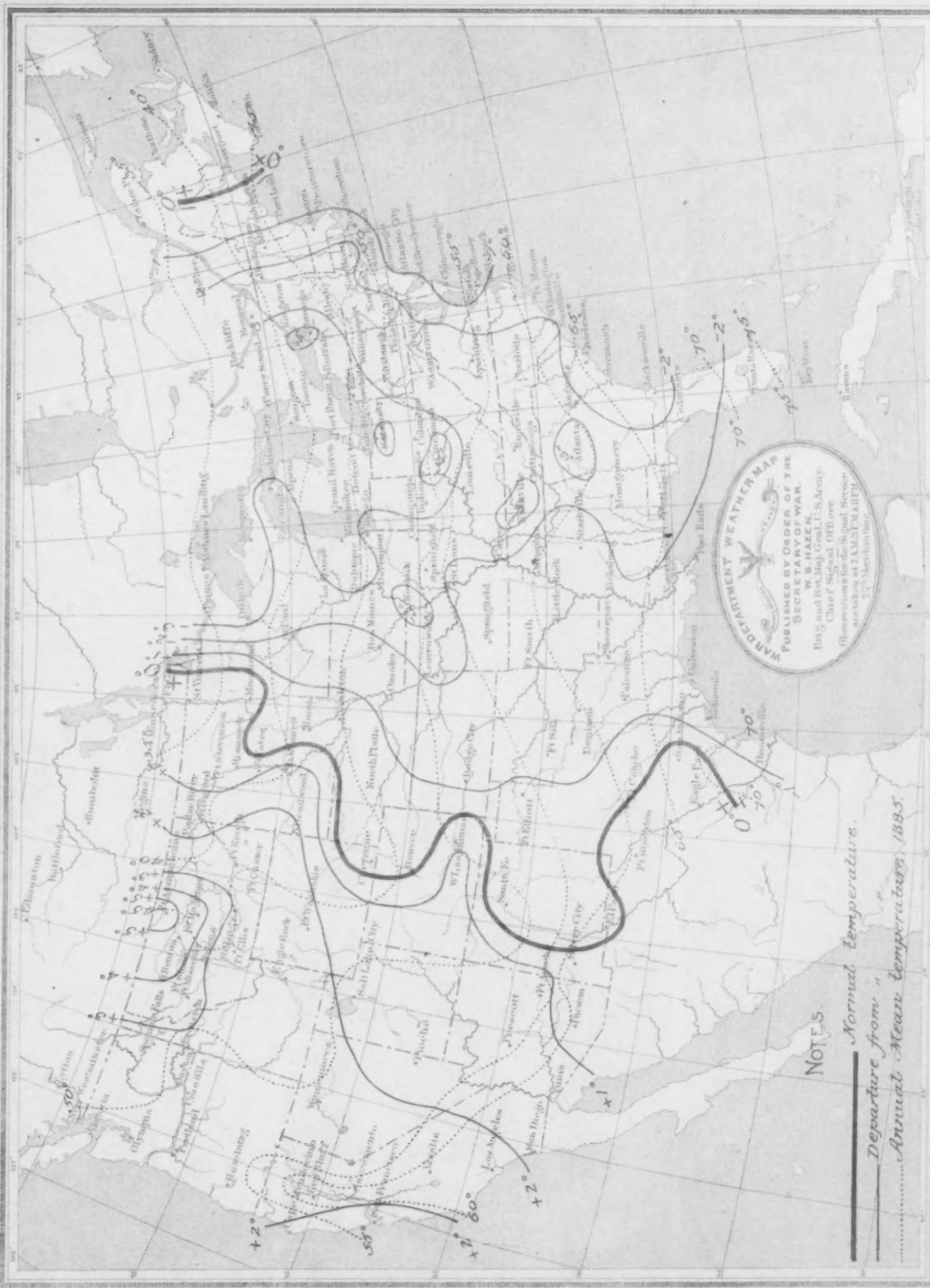
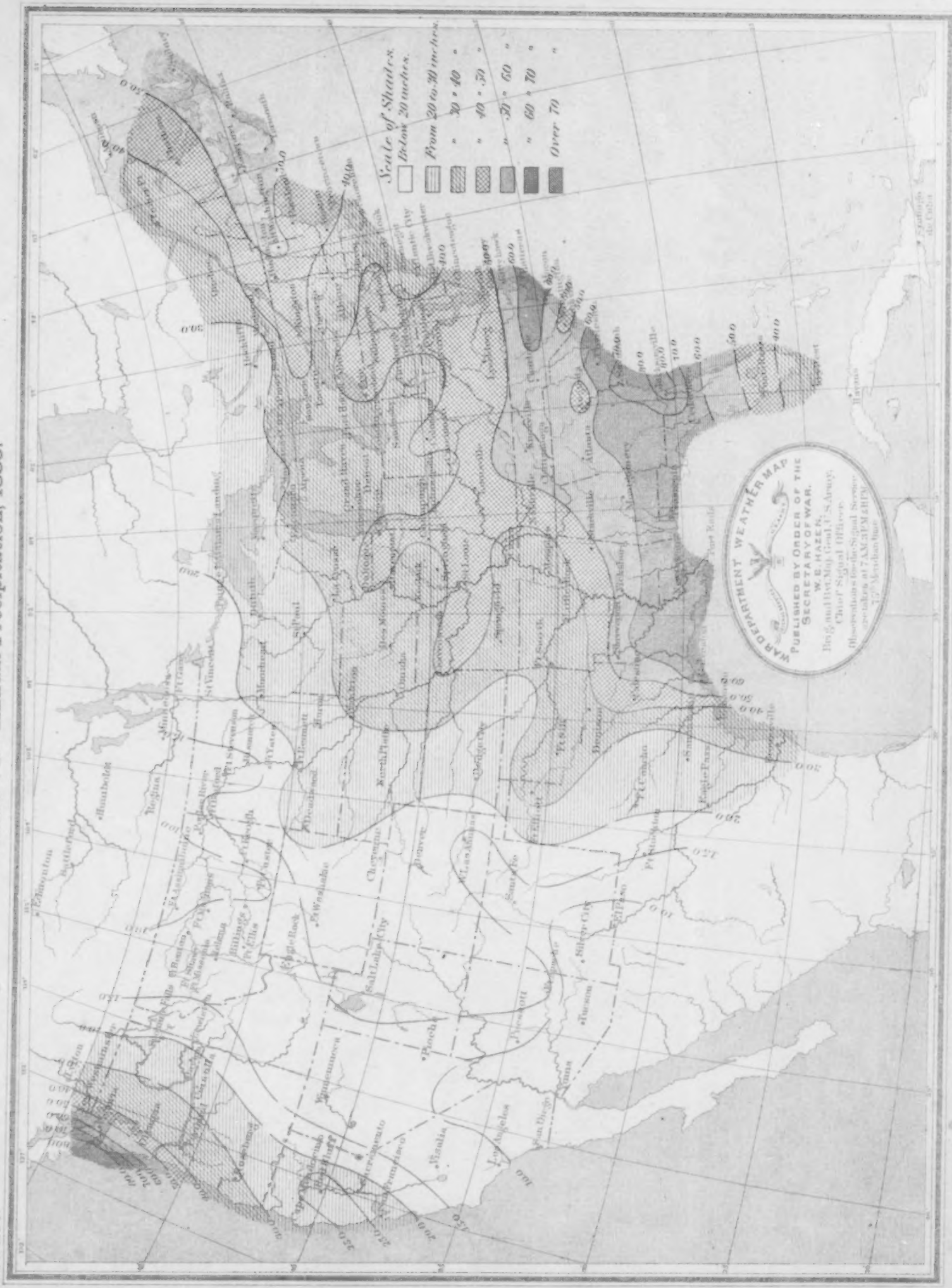






Chart VI. Annual Precipitation, 1885.







**Observer and place of observation.**  
 Adams, Effie, Logan, Iowa.  
 Alexander, S., Birmingham, Mich.  
 Anderson, Dr. W. W., Stateburg, S. C.  
 Altner, J. M., Independence, Kans.  
 Adams, Dr. O. H., Vineland, N. J.  
 Abbott, Dr. E. K., Salinas, Cal.  
 Arents, Hiram, Oroville, Cal.  
 Avey, O. H., Oskaloosa, Iowa.  
 Ames, A. H., Fort Meade, Fla.  
 Abbe, Capt. Lewis, Buckfield, Me.  
 Boerner, Prof. Chas. G., Vevay, Ind.  
 Ballou, Dr. N. E., Sandwich, Ill.  
 Boynton, John F., Syracuse, N. Y.  
 Bayerly, J. F., Spartanburg, S. C.  
 Bennett, Geo. Bandon, Oreg.  
 Bell, Joseph, Franklin, Pa.  
 Brainerd, Dr. H. G., Independence, Iowa.  
 Baker, Dr. Henry B., Lansing, Mich.  
 Beall, Dr. R. L., Lenoir, N. C.  
 Brendel, Dr. Fred., Peoria, Ill.  
 Bartlett, E. B., Vermillion, N. Y.  
 Baldwin, A. L., Bethel, Conn.  
 Briggs, John, Albany, Oreg.  
 Betts, Prof. Arthur, Webster, Dak.  
 Breed, J. E., Embarras, Wis.  
 Boyd, Joseph, Oskaloosa, Iowa.  
 Beebe, A., Manitique, Mich.  
 Boies, Lieut. A. H., Hudson, Mich.  
 Beans, T. J., Moorestown, N. J.  
 Barney, W., Stowe, Vt.  
 Blachly, C. P., Manhattan, Kans.  
 Burr, H. A., Campagna, Ill.  
 Beecher, Chas., Wysox, Pa.  
 Bowman, Peter, Ruggles, Ohio.  
 Cook, S. A., Milledgeville, Ga.  
 Calhoun, P. B., Austin, Tenn.  
 Coghill, Prof. E. B., Manhattan, Kans.  
 Cutler, J. L., Quitman, Ga.  
 Charbonnier, Prof. L. H., Athens, Ga.  
 Cotton, Dr. D. B., Portsmouth, Ohio.  
 Clark, A. C., Wausau, Wis.  
 Casey, Geo., Auburn, N. Y.  
 Crawford, E. A., Liberty Hill, La.  
 Curtiss, G. G., Fallston, Md.  
 Cornell University, Ithaca, N. Y.  
 Cutting, Dr. Hiram A., Lunenburg, Vt.  
 Crosier, Adam, Iaconia, Ind.  
 Caulkins, John S., Thornville, Mich.  
 Clark, T. A., Weldon, N. C.  
 Cass, John J., Allison, Kans.  
 Cleveland, Dr. G. H., Pentwater, Mich.  
 Carpenter, Dr. W. B., Leavenworth, K.  
 Christ, Jacob, Franklin, Wis.  
 Carpenter, Prof. L. G., Lansing, Mich.  
 Cheney, Wm., Minneapolis, Minn.  
 Culver, G. E., Vermillion, Dak.  
 Carter, Rev. Dr. W. H., Tallahassee, Fla.  
 Comstock, Prof. F. M., Le Roy, N. Y.  
 Chaffee, W. K., Carthage, Mo.  
 Collin, Prof. A., Mount Vernon, Iowa.  
 Cummings, L. D., Palmyra, N. Y.  
 Cooper, Dr. Geo. C., Manatee, Fla.  
 Corbin, F. E., Dudley, Mass.  
 Chubb, Thos. H., Post Mills, Vt.  
 Cole, Seward, Cahuenga, Cal.  
 Cutler, B. B., Heath, Mass.  
 Chapin, Adams, Poway, Cal.  
 Childs, W. H., Brattleborough, Vt.  
 Deings, H. D., Wellsborough, Pa.  
 Dozier, Wm., Mattoon, Ill.  
 Dewhurst, Rev. E., Voluntary, Conn.  
 Dunlap, W. L., Tecumseh, Nebr.  
 Day, Theodore, Dyberry, Pa.  
 Dawson, Wm., Spiceland, Ind.  
 Davis, W. O., Bloomington, Ill.  
 Dickson, J. P., Guttenberg, Iowa.  
 Duntun, Lieut. W. E., Dorset, Vt.

**Observer and place of observation.**  
 DeJongh, J. I., San José, Costa Rica.  
 Dow, Roswell, Sycamore, Ill.  
 Dinsmore, Jr., Prof. T. H., Emporia, Kans.  
 Dudley, C. B., Altoona, Pa.  
 Dunlap, J. B., Charleston, Ill.  
 Deebant, Wm. H., Mahanoy Plane, Pa.  
 Eliason, W. A., Statesville, N. C.  
 Eckstein, Rev. M., Conception, Mo.  
 Ellis, John, Marquette, Nebr.  
 Ellsworth, W. W., Hartford, Conn.  
 Everett, Dr. J. T., Clyde, Ohio.  
 Ewell, Dr. M. D., South Evanston, Ill.  
 Ferris, B. F., Sunman, Ind.  
 Fouch, Dr. A., College City, Cal.  
 Fuller, E. N., Tacoma, Wash. T.  
 Friend, Chas. W., Carson City, Nev.  
 Fleming, J., Readington, N. J.  
 Field, Thos. G., Parkersburg, W. Va.  
 Ferguson, W. Patterson, N. J.  
 Fernald, Prof. M. C., Orono, Me.  
 Gordon, Dr. Geo. G., Swartz Creek, Mich.  
 Gray, W. B., Morgan City, La.  
 Gibson, J. H., Salina, Kansas.  
 Geddings, Dr. W. H., Alken, S. C.  
 Gates, W. B., Burlington, Vt.  
 Grathwohl, John, Blooming Grove, Pa.  
 Gillingham, Minior, Fallington, Pa.  
 Gardiner, R. H., Gardiner, Me.  
 Govey, H. D., North Lewisburg, Ohio.  
 Green, Dr. Jesse C., West Chester, Pa.  
 Gerrish, S. H., Sacramento, Cal.  
 Gray, J. W., Stockham, Nebr.  
 Goodwin, Wm., North Colebrook, Conn.  
 Gray, F. R., Yates Center, Kans.  
 Gillingham, W., Acetotink, Va.  
 Garlick, Rev. Dr. J. R., Bruington, Va.  
 Gray, Capt. A. W., Kenewick, Wash. T.  
 Heath, E. R., Wyandotte, Kans.  
 Horn, Dr. H. B., Atchison, Kans.  
 Hiram College, Hiram, Ohio.  
 Harvard College Observatory, Cambridge, Mass.  
 Hammitt, John W., College Hill, Ohio.  
 Heaton, Isaac E., Fremont, Nebr.  
 Helm, Thos. B., Lozanoport, Ind.  
 Hoskinson, R. M., Bainbridge Island, Wash. Ter.  
 Hyde, G. A., Cleveland, Ohio.  
 Haywood, John, Westerville, Ohio.  
 Hassler, B. K., Chambersburg, Pa.  
 Hartzler, J. A., Mottville, Mich.  
 Hall, J. B., Worcester, Mass.  
 Hager, Mrs. L. G., Terre Haute, Ind.  
 Howe, Prof. J. L., Richmond, Ky.  
 Houghton Farm Experiment Station, Mountaineville, N. Y.  
 Hering, Dr. J. C., Paramaribo, Dutch Guiana, S. A.  
 Heatwole, L. J., Dale Enterprise, Va.  
 Harper, Geo. W., Cincinnati, Ohio.  
 Hazen, Rev. A., Deerfield, Mass.  
 Hamilton, W. H., Corsicana, Texas.  
 Hatch, A. H., Windsor, Ill.  
 Harris, W. C., Dover, N. J.  
 Hodge, Rev. F. B., Wilkesbarre, Pa.  
 Humphrey, Dr. L., Fairbury, Nebr.  
 Heacock, J. L., Quakertown, Pa.  
 Harris, T. C., Raleigh, N. C.  
 Hurlin, Rev. Wm., Antrim, N. H.  
 James, John W., Marengo, Ill.  
 Jones, Dr. E. U., Taunton, Mass.  
 Jackson Company, Nashua, N. H.  
 Jordan, Dr. M. D. L., Milan, Tenn.  
 Jones, Ira B., Neillsville, Wis.  
 Jones, F. M., Puerto de Luna, N. Mex.

**Observer and place of observation.**  
 Kirkwood, E., Manzy, Ind.  
 Knapp, J. G., Limona, Fla.  
 Keese, G., Pomeroy, Cooperstown, N. Y.  
 Kuhne, F. W., Fort Wayne, Ind.  
 King, W. H., Yellow Springs, Ohio.  
 Kauffman, H. W., Quakertown, Pa.  
 Kedzie, Dr. H. Midland, Tex.  
 Kent, Miss E., Phillipsburg, N. J.  
 Lueps, Miss Anna, Manitowoc, Wis.  
 Lincoln, A. T., Marlon, Va.  
 Loomis, J. C., Jeffersonville, Ind.  
 Lay, Dr. F. H., Pueblo, Colo.  
 Luther, S. M., Garrettsville, Ohio.  
 Lashaw, Geo. E., Paeolet, S. C.  
 Lovewell, Prof. J. T., Topeka, Kans.  
 Lamb, Miss Bertha E., Sterling, Kans.  
 McPherson, Wm., Ross Valley, Cal.  
 McDonough Institute, McDonough, Md.  
 McCready, Miss L. A., Fort Madison, Mo.  
 Moore, C. R., Bird's Nest, Va. [Iowa].  
 Mickle, J. H., Variety Mills, Va.  
 Metcalf, Dr. John G., Mendon, Mass.  
 McKenzie, Dr. M., Centreville, Mo.  
 Macrae, Colin, Kirkwood, S. C.  
 Meehan, Thos., Germantown, Pa.  
 Moore, Nathan, Grampian Hills, Pa.  
 Mikesell, Thos., Wauseon, Ohio.  
 Marshall, G., Cresco, Iowa.  
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 Miller, H. D., Drifton, Pa.  
 Moore, Dr. J. W., Easton, Pa.  
 Motte, L. S., West Melton, Ohio.  
 Nordberg, A., Richardson, Dak.  
 Neal, Dr. J. C., Archer, Fla.  
 Newbegin, John D., Anna, Ill.  
 Newcomb, G. S., Westborough, Mass.  
 Noll, A. B., Somerville, N. J.  
 Nourse, H. D., Washington, D. C.  
 Norcom, Prof. T. J., Reidsville, N. C.  
 Osborn, Dr. Thos. C., Cleburne, Tex.  
 Olds, H. D., Cedar Rapids, Iowa.  
 Owsley, Dr. J. B., Jacksonborough, O.  
 Parker, D., Humboldt, Iowa.  
 Pearce, Thomas, Eola, Oreg.  
 Pritchett, Prof. H. C., Huntsville, Tex.  
 Partrick, J. M., North Volney, N. Y.  
 Purdue University, Lafayette, Ind.  
 Pettersen, Dr. F., Comfort, Tex.  
 Pendleton, A., Nicolaus, Cal.  
 Payne, Prof. W. W., Carleton College, Northfield, Minn.  
 Rotch, A. L., Blue Hill Obs'y, Mass.  
 Randall, E. H., Poultney, Vt.  
 Renfrew, H. N., Bancroft, Iowa.  
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 Robertson, T. D., Rockford, Ill.  
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 Rodman, T. R., New Bedford, Mass.  
 Range, C., New Ulm, Tex.  
 Richardson, C. F., Beverly, N. J.  
 Starr, Prof. F., Cedar Rapids, Iowa.  
 Shaw, E., Nimesab, Kan.  
 Strong, W. C., Kents Hill, Me.  
 Sanders, T. B., Susanville, Cal.  
 Simmons, Prof. W. G., Wake Forest, N. C.  
 Shriver, E. T., Cumberland, Md.  
 Seltz, Chas., De Soto, Nebr.  
 Scott, Thos. G., Forsyth, Ga.  
 Stucky, Dr. C. T., Helvetia, W. Va.  
 Slade, Eliza, Somerset, Mass.  
 Shriver, Howard, Wytheville, Va.  
 Sonederker, Rev. T. H., Fostoria, Ohio.  
 Slenker, Mrs. E. D., Snowville, Va.  
 Snow, Prof. F. H., Lawrence, Kans.  
 Sullivan, J. F., Braddock, Col.

**Observer and place of observation.**  
 Sim, J. R., Summit, Va.  
 Scribner, H. F. J., Strafford, Vt.  
 Sargent, J. B., Leicester, Mass.  
 Strong, S. B., Setauket, N. Y.  
 Somerville, W. B., Birmingham, Ala.  
 Samostz, Oscar, Austin, Tex.  
 Shepard, E. M., Springfield, Mo.  
 Smith, H. D., Monticello, Iowa.  
 Safford, A. T., Williamstown, Mass.  
 Sherman, W. B., Manchester, Iowa.  
 Smith, Rev. D. W., Troy, Pa.  
 Standenmayer, Dr. L. R., Lincoln, N. C.  
 Spilman, J. J., Pierce City, Mo.  
 Stone, W. E., Amherst, Mass.  
 Swezey, Prof. G. D., Crete, Nebr.  
 Sacred Heart College, Prairie du Chien, Wis.  
 Tyrrel, A. C., Madison, Nebr.  
 Trembley, Dr. J. B., Oakland, Cal.  
 Todd, Prof. David P., Amherst, Mass.  
 Thornton, Prof. N. C., Geneseo,

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Assinaboine, Fort, Mont.	David's Island, N. Y. H.	Mason, Fort, Cal.	Meade, Fort, Dak.	Robinson, Fort, Nebr.	Townsend, Fort, Wash. T
A. Lincoln, Fort, Dak.	Ellis, Fort, Mont.	Madison Barracks, N. Y.	Niagara, Fort, N. Y. [Cal.	Snelling, Fort, Minn.	Wingate, Fort, N. Mex.
Benicia Barracks, Cal.	Fred Steele, Fort, Wyo.	McDermitt, Fort, Nev.	Presidio of San Francisco,	Saint Augustine, Fla.	West Point, N. Y.
Bidwell, Fort, Cal.	Gaston, Fort, Cal.	Monroe, Fort, Va.	Plattsburg Barracks, N. Y.	Sully, Fort, Dak.	Yates, Fort, Dak.
Brady, Fort, Mich.	Keogh, Fort, Mont.	McDowell, Fort, Ariz.	Pembina, Fort, Dak.	Sisseton, Fort, Dak.	
Bridger, Fort, Wyo.	Klamath, Fort, Oreg.				

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Alabama State Weather Service, under direction of Prof. P. H. Mell, jr., Auburn, Alabama.  
Indiana State Weather Service, under direction of Prof. H. A. Huston, La Fayette, Indiana.  
Indiana State Weather Service, under direction of Prof. W. H. Ragan, De Pauw University, Greencastle, Indiana.  
Iowa State Weather Service, under direction of Dr. Gustavus Hinrichs, Iowa City, Iowa.  
Minnesota State Weather Service, under direction of Prof. W. W. Payne, Northfield, Minnesota.  
Missouri State Weather Service, under direction of Prof. Francis E. Nipher, Saint Louis, Missouri.  
Nebraska Weather Service, under direction of Prof. Goodwin D. Swezey, Crete, Nebraska.  
New England Meteorological Society. Prof. Winslow Upton of Providence, R. I., President; Prof. W. M. Davis, of Cambridge, Mass., Secretary.  
Ohio State Weather Service, under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus, Ohio.  
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